The Honorable James L. Robart

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

PUMA SE, and PUMA North America Inc., Plaintiffs, v. Brooks Sports, Inc., Defendant.	)))))))))	Case No. 2:24-cv-00940-JLR JURY DEMAND

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs, PUMA SE and PUMA North America Inc. (collectively, "PUMA"), by and through undersigned counsel, bring this action for patent infringement against Defendant Brooks Sports, Inc. ("Brooks"), and by and for their First Amended Complaint, allege as follows:

NATURE OF THE ACTION

1. This is an action for patent infringement seeking to remedy Brooks' ongoing disregard for PUMA's intellectual property rights through the manufacture, use, sale, offer for sale and importation of athletic shoes that infringe PUMA's patents. Indeed, Brooks' infringing activity has continued even after PUMA provided notice to Brooks of at least PUMA's U.S. Patent Number 11,825,904 to Brooks' VP Legal & General Counsel. This action seeks a permanent injunction and the recovery of monetary damages stemming from Brooks' infringement of nine of PUMA's patents, specifically United States Patent Nos. 11,825,904 ("the '904 Patent"), 11,974,629 ("the '629 Patent"), 11,974,630 ("the '630 Patent"), 12,016,422 ("the '422 Patent"), 12,096,816 ("the '816 Patent"), D1,022,421 ("the D'421 Patent"), D1,022,422 ("the D'422 Patent"), D1,023,531 ("the D'531 Patent"), D1,021,356 ("the D'356 Patent"), and D1,009,432 ("the D'432 Patent") (collectively, "the Asserted Patents").

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PARTIES

2. Plaintiffs PUMA SE and PUMA North America Inc. are world leaders in the sportswear industry.

3. PUMA SE is organized and existing under the laws of Germany, with its principal place of business at Puma Way 1, 91074 Herzogenaurach, Germany. PUMA SE is a multinational company that designs and manufactures athletic and casual footwear, apparel, and accessories. PUMA SE employs more than 20,000 people worldwide and distributes its products in more than 120 countries, with over 9.3 Billion dollars in sales in 2023.

4. PUMA North America Inc. is a Delaware corporation with its principal place of business at 455 Grand Union Blvd, Somerville, MA 02145.

5. PUMA North America directs all U.S.-based operations on behalf of PUMA SE, including sales, brand marketing, product marketing, product design, public relations, distribution, enforcement, and licensing of and for PUMA-branded merchandise.

6. PUMA North America is a licensee of patents owned by PUMA SE for purposes of PUMA North America's U.S. sales activities.

7. Defendant Brooks Sports, Inc. is a Washington corporation, with its principal place of business at 3400 Stone Way N, Suite 500, Seattle, WA 98103.

JURISDICTION AND VENUE

8. This is an action for patent infringement under the patent laws of the United States, namely, 35 U.S.C. §§ 101 et seq., 271, 281, and 284, among others. This Court has original subject matter jurisdiction over this dispute pursuant to 28 U.S.C. §§ 1331 and 1338(a).

9. This Court has general personal jurisdiction over Brooks because it is a Washington corporation with its principal place of business in Seattle, Washington.

10. Venue is also proper in this district pursuant to 28 U.S.C. § 1400(b) because Brooks has committed acts of patent infringement in this district and its principal place of business in this district, located in Seattle, Washington.

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FACTS AND BACKGROUND

11. PUMA has a long, storied history in the running industry, and specifically in the development of track and field spikes and running shoes.

12. While operating as Dassler Brothers Shoe Factory, a predecessor to PUMA, the original founding Dassler Brothers drove from Bavaria to the 1936 Summer Olympics in Berlin with a suitcase full of track and field running spikes and persuaded United States sprinter Jesse Owens to use them. Owens won four gold medals in the Dassler track and field spikes.

13. In 1948, the brothers split the business, and what is today PUMA was formed.

14. Since 1948, PUMA has drawn strength and credibility from its heritage in sports and has continued its legacy of innovation, repeatedly designing shoes worn by track and field gold medal Olympic athletes.

15. PUMA's innovation continues through today.

16. In February of 2024, PUMA running shoes were worn by the first and third place runners in the women's Olympic Trials Marathon, setting a women's Olympic Trials record.

17. PUMA's innovation has been possible due to PUMA's continued investment in research, development and design efforts, striving to make PUMA's athletes forever faster.

18. To protect its investment in innovation, PUMA seeks patent protection for its unique contributions to the running space, having obtained both utility and design patents on its running shoes and track spikes.

19. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the '904 Patent. A true and correct copy of the '904 Patent is attached hereto as Exhibit A.

20. After the priority date of the '904 Patent, Brooks introduced a shoe, the "Hyperion Elite MD," that infringes at least Claim 14 of the '904 Patent. The Hyperion Elite MD is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/featured/unisex-running-shoes/hyperion-elite-md/100048.html.

21. As shown below, the Hyperion Elite MD meets every limitation of Claim 14 of the

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’904 Patent. The claim chart below shows photographs of the shoe in its entirety as well as cut in half from toe to heel.

’904 Patent, Claim 14	Hyperion Elite MD
A sole structure for an article of footwear having an upper, the sole structure comprising:	
a first cushioning member;	
a second cushioning member that is spaced apart from the first cushioning member by a gap that extends between the first cushioning member and the second cushioning member; and	
a sole plate that extends across the gap from the first cushioning member to the second cushioning member, the sole plate extending away from the upper moving across the gap from the first cushioning member to the second cushioning member, wherein the sole plate is positioned within at least one of the first cushioning member and the second cushioning member.	

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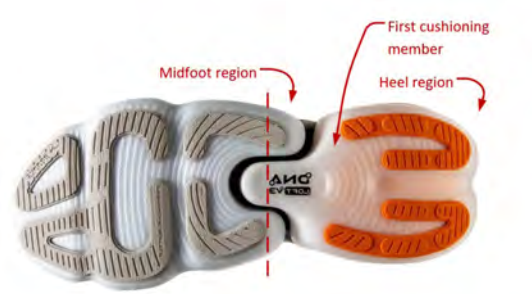
22. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the ’629 Patent. A true and correct copy of the ’629 Patent is attached hereto as Exhibit B.

23. After the priority date of the ’629 Patent, Brooks introduced a shoe, the “Aurora-BL,” that infringes at least Claim 1 of the ’629 Patent. The shoe is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/womens/shoes/road-running-shoes/aurora-bl/120354.html.

24. As shown below, the Aurora-BL meets every limitation of Claim 1 of the ’629 Patent.

’629 Patent, Claim 1	Aurora-BL
An article of footwear having a sole structure and an upper, the sole structure comprising:	
a first cushioning member directly coupled to the upper and extending continuously between a heel region and a midfoot region of the sole structure; and	

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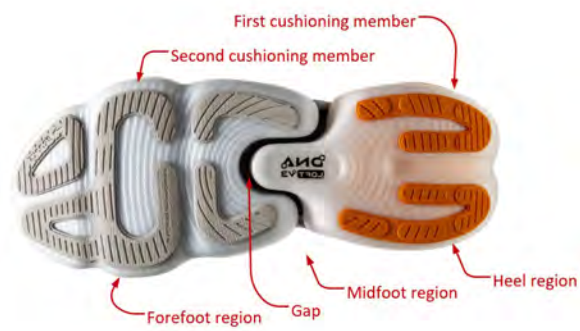
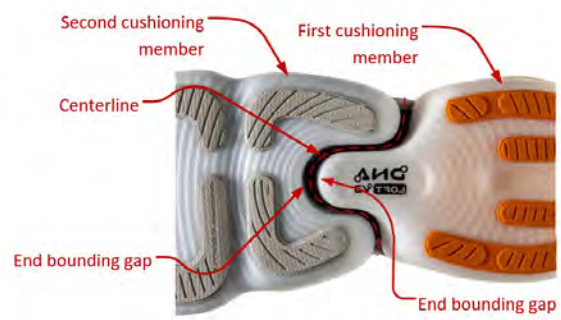
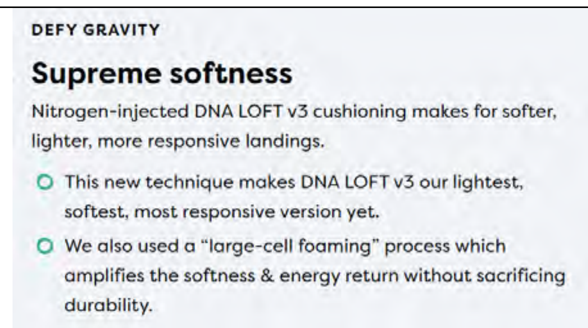
’629 Patent, Claim 1	Aurora-BL
a second cushioning member directly coupled to the upper and extending continuously between a forefoot region and the midfoot region of the sole structure,	
wherein the first cushioning member and the second cushioning member overlap in the midfoot region and are spaced apart to define a gap that extends between the first cushioning member and the second cushioning member in the midfoot region of the sole structure,	
the gap having a centerline defined between the first cushioning member and the second cushioning member, the centerline following a contour of an end of at least one of the first cushioning member and the second cushioning member that bounds the gap when viewed from a bottom of the article of footwear;	
and wherein at least one of the first cushioning member or the second cushioning member are a supercritical foam.	

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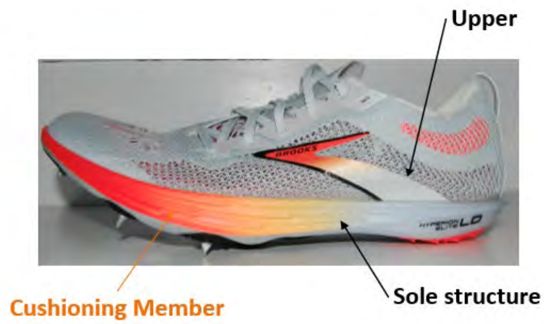
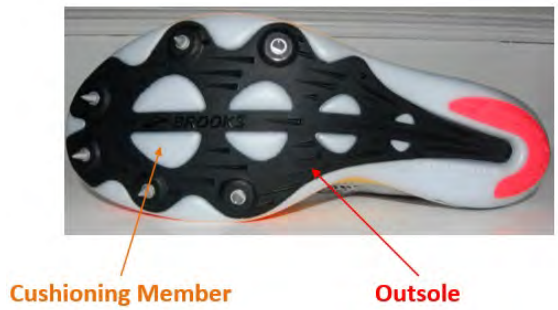
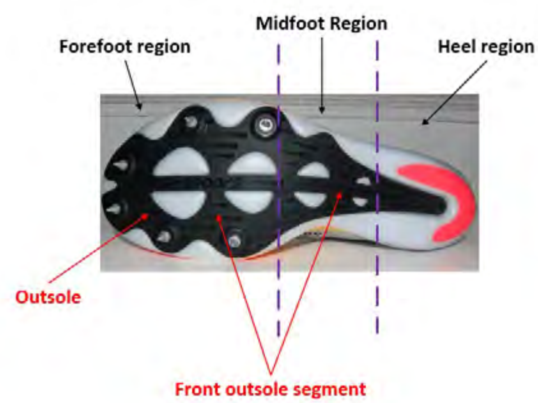
25. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the ’630 Patent. A true and correct copy of the ’630 Patent is attached hereto as Exhibit C.

26. After the priority date of the ’630 Patent, Brooks introduced a shoe, the “Hyperion Elite LD,” that infringes at least Claim 15 of the ’630 Patent. The shoe is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/featured/unisex-running-shoes/hyperion-elite-ld/100047.html.

27. As shown below, the Hyperion Elite LD meets every limitation of Claim 15 of the ’630 Patent. The claim chart below shows photographs of the shoe.

’630 Patent, Claim 15	Hyperion Elite LD
An article of footwear comprising:	
an upper; and	
a sole structure coupled to the upper and defining a ground engaging surface,	

’630 Patent, Claim 15	Hyperion Elite LD
the sole structure including: a cushioning member coupled to the upper; and	
an outsole coupled to the cushioning member,	
the outsole including a front outsole segment positioned in a forefoot region and a midfoot region, and	
a rear outsole segment positioned in a heel region and discontinuous with the front outsole segment along the ground engaging surface,	

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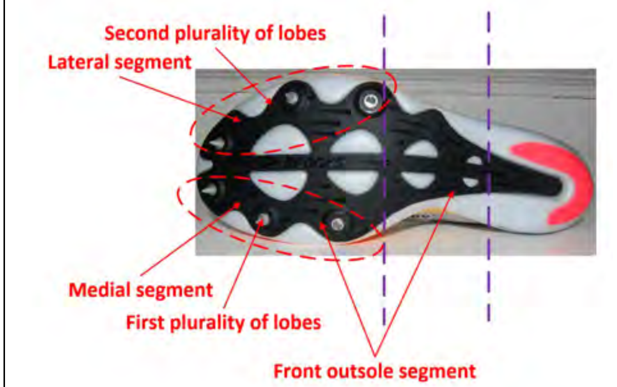
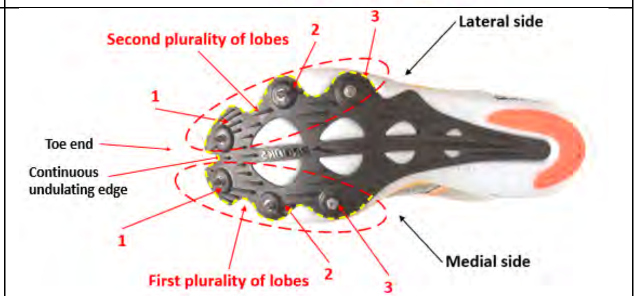
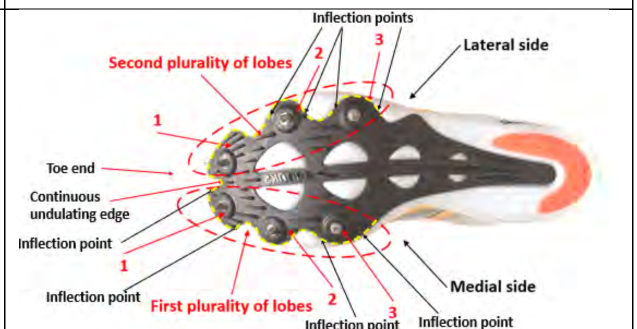
’630 Patent, Claim 15	Hyperion Elite LD
the front outsole segment including a medial segment with a first plurality of lobes arranged along a medial side of the sole structure and a lateral segment with a second plurality of lobes arranged along a lateral side of the sole structure,	
wherein each of the first plurality of lobes and the second plurality of lobes includes at least two lobes that are disposed entirely within the forefoot region such that the outsole has a continuous undulating peripheral edge extending around a toe end of the sole structure from a lateral side to a medial side, and	
wherein the undulating peripheral edge defines at least four inflection points along the lateral side and at least four inflection points along the medial side within the forefoot region and the midfoot region.	

28. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the ’422 Patent. A true and correct copy of the ’422 Patent is attached hereto as Exhibit D.

29. After the priority date of the ’422 Patent, Brooks introduced a shoe, the “Hyperion Elite 4,” that infringes at least Claim 14 of the ’422 Patent. The shoe is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/featured/unisex-running-shoes/hyperion-elite-4/100046.html.

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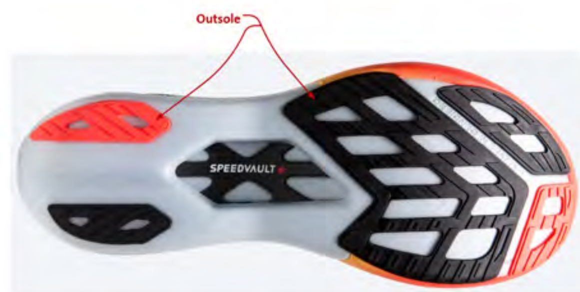
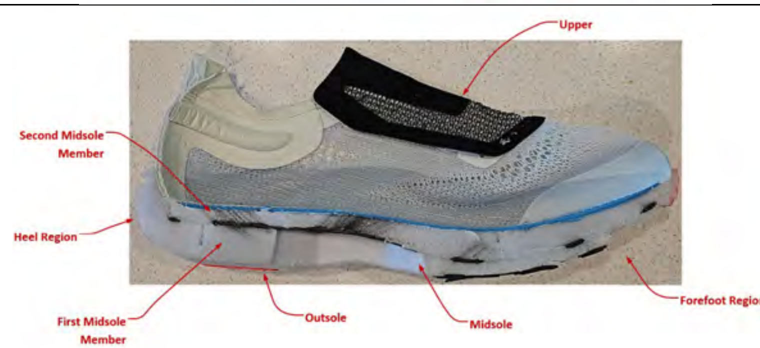
30. As shown below, the Hyperion Elite 4 meets every limitation of Claim 14 of the ’422 Patent. The claim chart below shows photographs of the shoe in its entirety as well as cut in half from toe to heel.

’422 Patent, Claim 14	Hyperion Elite 4
A sole structure for an article of footwear having an upper, the sole structure comprising:	
an outsole;	
a midsole extending between the outsole and the upper, the midsole including a first midsole member coupled to the outsole and extending from a forefoot region to a heel region of the sole structure,	

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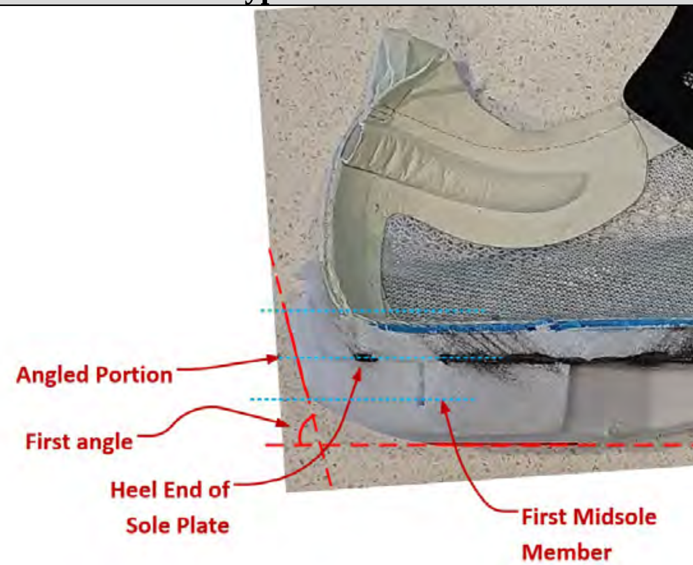
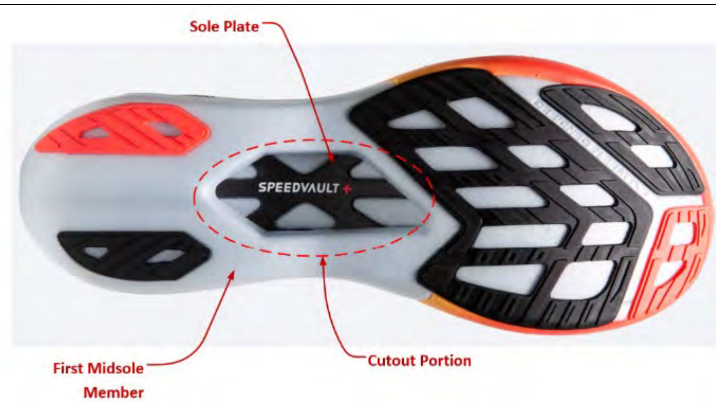
’422 Patent, Claim 14	Hyperion Elite 4
the first midsole member defining an entry region at a heel end in which the first midsole member defines a substantially flat angled portion that is angled away from a ground surface by a first angle that is configured to increase contact at a ground engaging surface of the first midsole member during a heel strike, and	
a second midsole member coupled to the upper and positioned between the first midsole member and the upper, the second midsole member extending from the heel region to the forefoot region; and	
a sole plate positioned within the midsole between the first midsole member and the second midsole member,	
the sole plate being exposed at a cutout portion in the first midsole member,	

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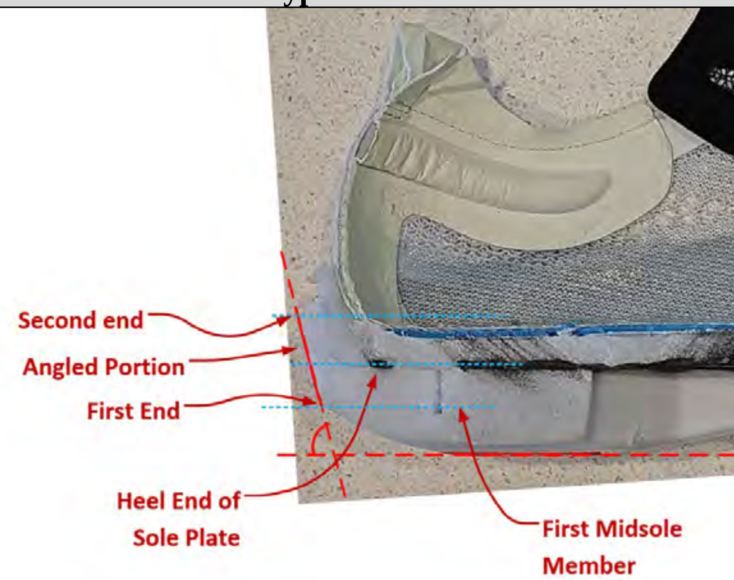
’422 Patent, Claim 14	Hyperion Elite 4
wherein the substantially flat angled portion of the entry region extends from a first end to a second end, the first end being positioned below a heel end of the sole plate and the second end being positioned above the heel end of the sole plate.	

31. After the priority date of the ’422 Patent, Brooks introduced a shoe, the “Hyperion Max 2,” that infringes at least Claim 14 of the ’422 Patent. The shoe is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/mens/shoes/road-running-shoes/hyperion-max-2/110434.html.

32. As shown below, the Hyperion Max 2 meets every limitation of Claim 14 of the ’422 Patent. The claim chart below shows photographs of the shoe in its entirety as well as cut in half from toe to heel.

’422 Patent, Claim 14	Hyperion Max 2
A sole structure for an article of footwear having an upper, the sole structure comprising:	

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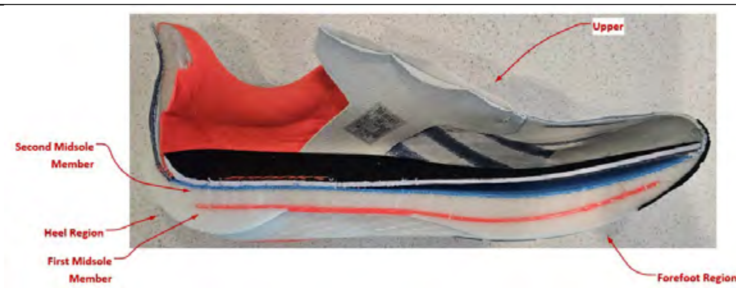
'422 Patent, Claim 14	Hyperion Max 2
an outsole;	
a midsole extending between the outsole and the upper, the midsole including a first midsole member coupled to the outsole and extending from a forefoot region to a heel region of the sole structure,	
the first midsole member defining an entry region at a heel end in which the first midsole member defines a substantially flat angled portion that is angled away from a ground surface by a first angle that is configured to increase contact at a ground engaging surface of the first midsole member during a heel strike, and	
a second midsole member coupled to the upper and positioned between the first midsole member and the upper, the second midsole member extending from the heel region to the forefoot region; and	

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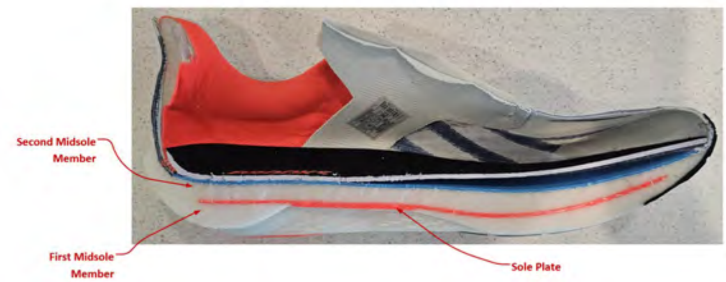
’422 Patent, Claim 14	Hyperion Max 2
a sole plate positioned within the midsole between the first midsole member and the second midsole member,	
the sole plate being exposed at a cutout portion in the first midsole member,	
wherein the substantially flat angled portion of the entry region extends from a first end to a second end, the first end being positioned below a heel end of the sole plate and the second end being positioned above the heel end of the sole plate.	

33. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the ’816 Patent. A true and correct copy of the ’816 Patent is attached hereto as Exhibit J.

34. After the priority date of the ’816 Patent, Brooks introduced shoes that infringe at least Claims 18 through 28 of the ’816 Patent.

35. Brooks shoes, including without limitation certain products within the Hyperion line of shoes, practice every limitation of Claim 18 of the ’816 Patent.

36. As shown below in a representative example, the Brooks Hyperion Elite 4

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infringes Claim 18 of the ’816 Patent. The shoe is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/featured/unisex-running-shoes/hyperion-elite-4/100046.html. The claim chart below shows photographs of the shoe in its entirety as well as cut in half from toe to heel.

’816, Claim 1	Brooks Hyperion Elite 4
A sole structure for an article of footwear having an upper, the sole structure comprising:	
an outsole;	

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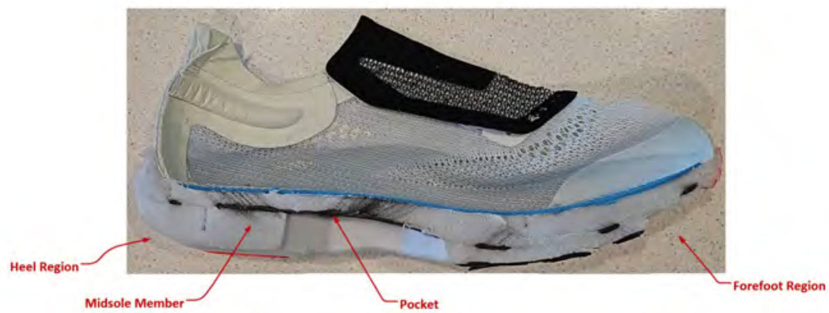
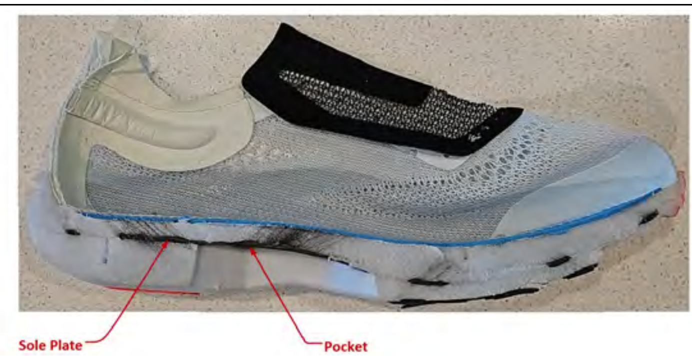
’816, Claim 1	Brooks Hyperion Elite 4
a midsole member disposed between the outsole and the upper,	
the midsole member having a pocket extending from a heel region to a forefoot region;	
and a sole plate disposed within the pocket,	
the sole plate extending from the heel region into the forefoot region,	

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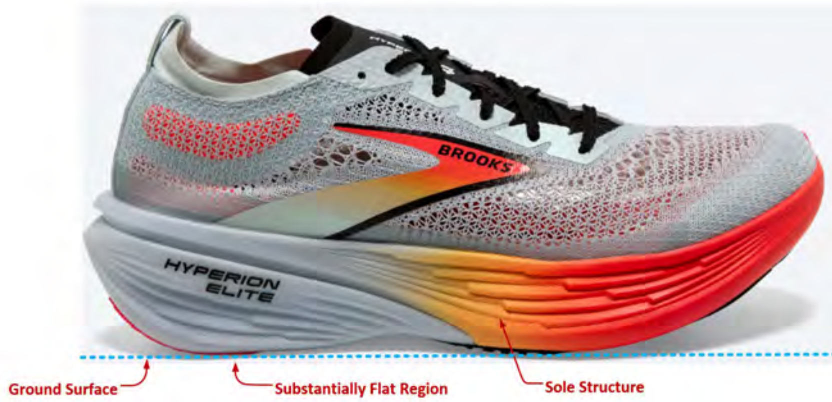
’816, Claim 1	Brooks Hyperion Elite 4
wherein the sole structure defines a substantially flat region upon which the sole structure is configured to rest when in contact with a ground surface,	
the substantially flat region defining a resting plane,	
wherein, in the heel region, the sole structure is shaped to define an entry region that is configured to form a gap between the midsole member and the resting plane,	

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'816, Claim 1	Brooks Hyperion Elite 4
the entry region curving upward to form an angled portion that is substantially flat between a first end and a second end so that the angled portion is configured to be angled at an entry angle relative to the ground surface when viewed from a lateral side or a medial side of the sole structure,	

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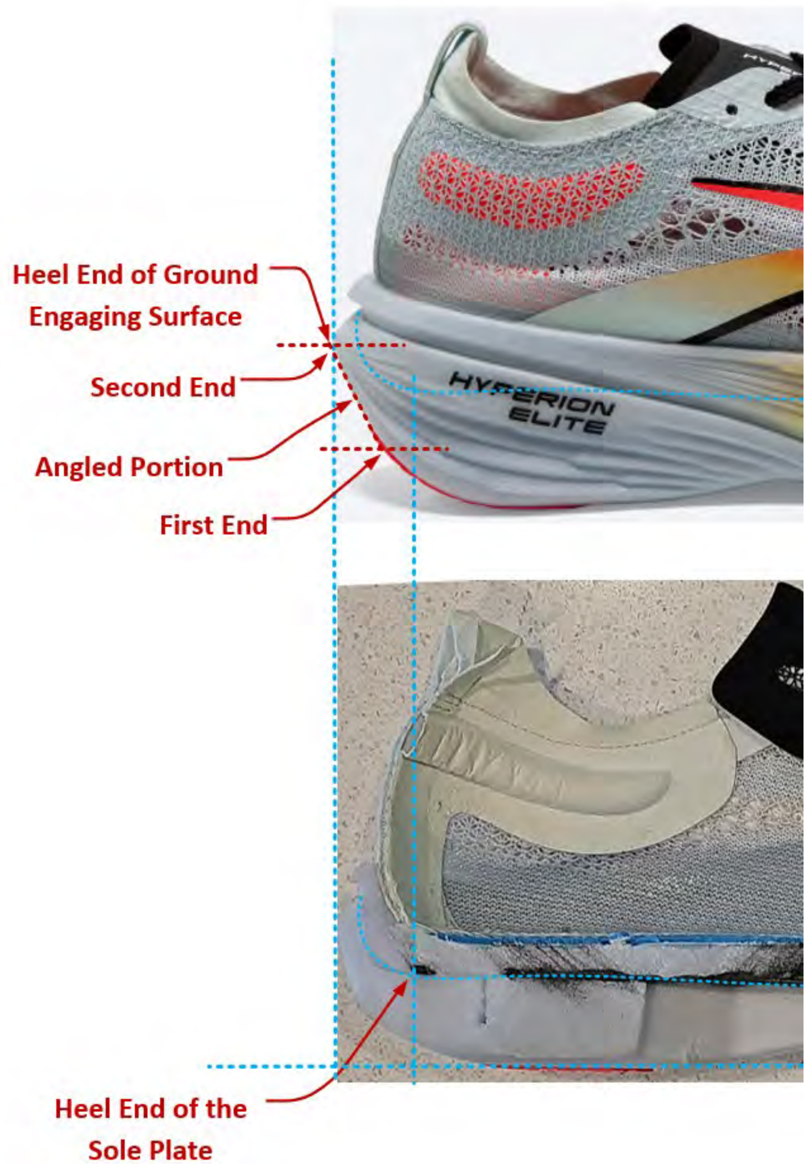
’816, Claim 1	Brooks Hyperion Elite 4
wherein the first end of the angled portion is below a heel end of the sole plate and the second end of the angled portion is above the heel end of the sole plate to define a heel end of a ground engaging surface that is above the heel end of the sole plate,	

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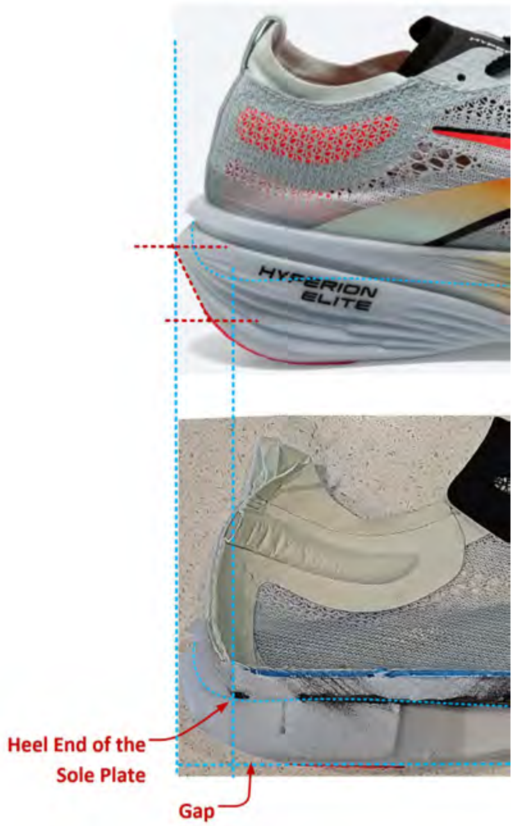
’816, Claim 1	Brooks Hyperion Elite 4
and wherein the heel end of the sole plate is positioned over the gap	

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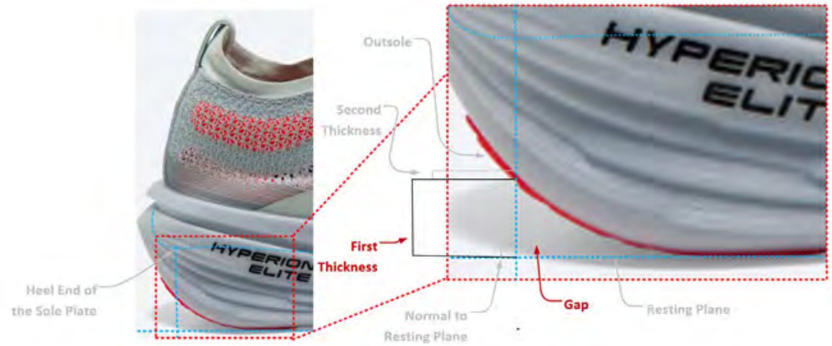
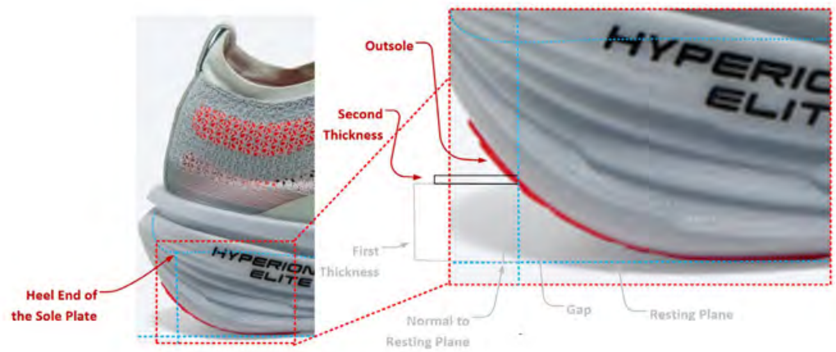
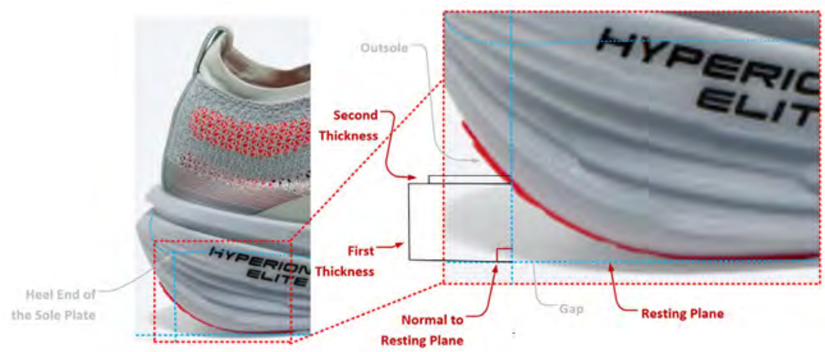
<table>
<tr><th>’816, Claim 1</th><th>Brooks Hyperion Elite 4</th></tr>
<tr><td>where the gap has a first thickness that is greater than a second thickness of the outsole at the heel end of the sole plate, each of the first thickness and the second thickness taken along a direction that is normal to the resting plane.</td><td>






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’816, Claim 18	Brooks Hyperion Elite 4
The sole structure of claim 1, wherein the midsole member includes an arched section in a midfoot region.	

37. As shown below in a representative example, the Brooks Hyperion Max 2 infringes Claim 18 of the ’816 Patent. The shoe is available for sale to the public throughout the United States through https://www.brooksrunning.com/en_us/mens/shoes/road-running-shoes/hyperion-max-2/110434.html. The claim chart below shows photographs of the shoe in its entirety as well as cut in half from toe to heel.

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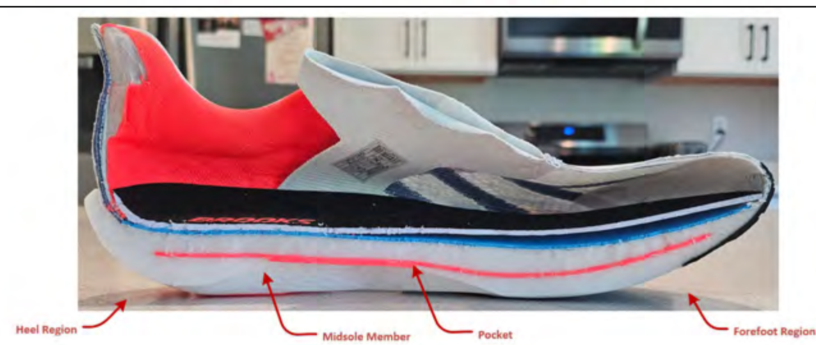
’816, Claim 1	Brooks Hyperion Max 2
A sole structure for an article of footwear having an upper, the sole structure comprising:	
an outsole;	
a midsole member disposed between the outsole and the upper,	
the midsole member having a pocket extending from a heel region to a forefoot region;	

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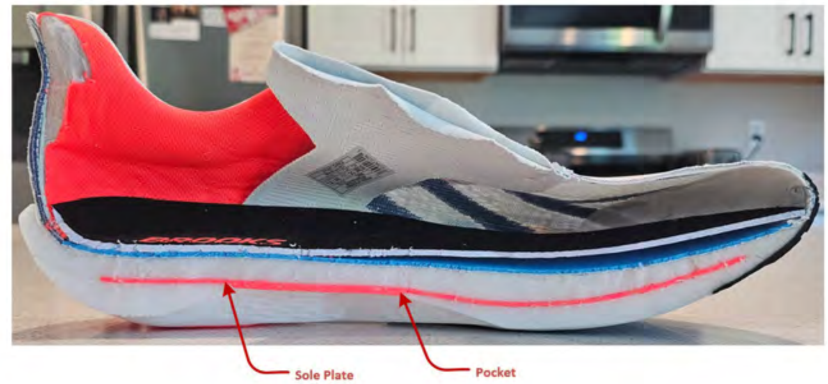
’816, Claim 1	Brooks Hyperion Max 2
and a sole plate disposed within the pocket,	
the sole plate extending from the heel region into the forefoot region,	
wherein the sole structure defines a substantially flat region upon which the sole structure is configured to rest when in contact with a ground surface,	
the substantially flat region defining a resting plane,	

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’816, Claim 1	Brooks Hyperion Max 2
wherein, in the heel region, the sole structure is shaped to define an entry region that is configured to form a gap between the midsole member and the resting plane,	
the entry region curving upward to form an angled portion that is substantially flat between a first end and a second end so that the angled portion is configured to be angled at an entry angle relative to the ground surface when viewed from a lateral side or a medial side of the sole structure,	

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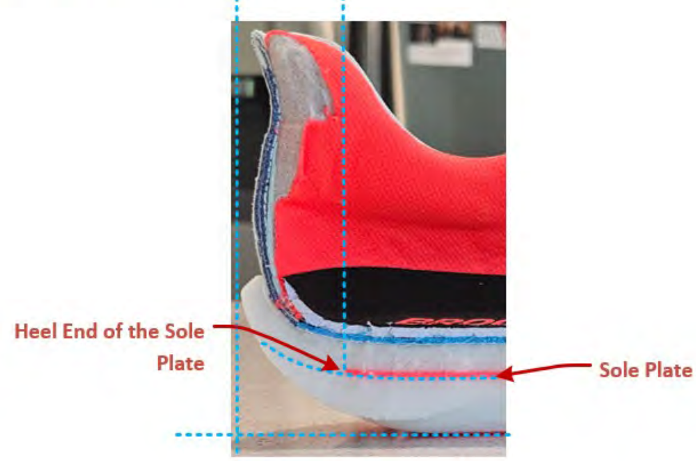
’816, Claim 1	Brooks Hyperion Max 2
wherein the first end of the angled portion is below a heel end of the sole plate and the second end of the angled portion is above the heel end of the sole plate to define a heel end of a ground engaging surface that is above the heel end of the sole plate,	

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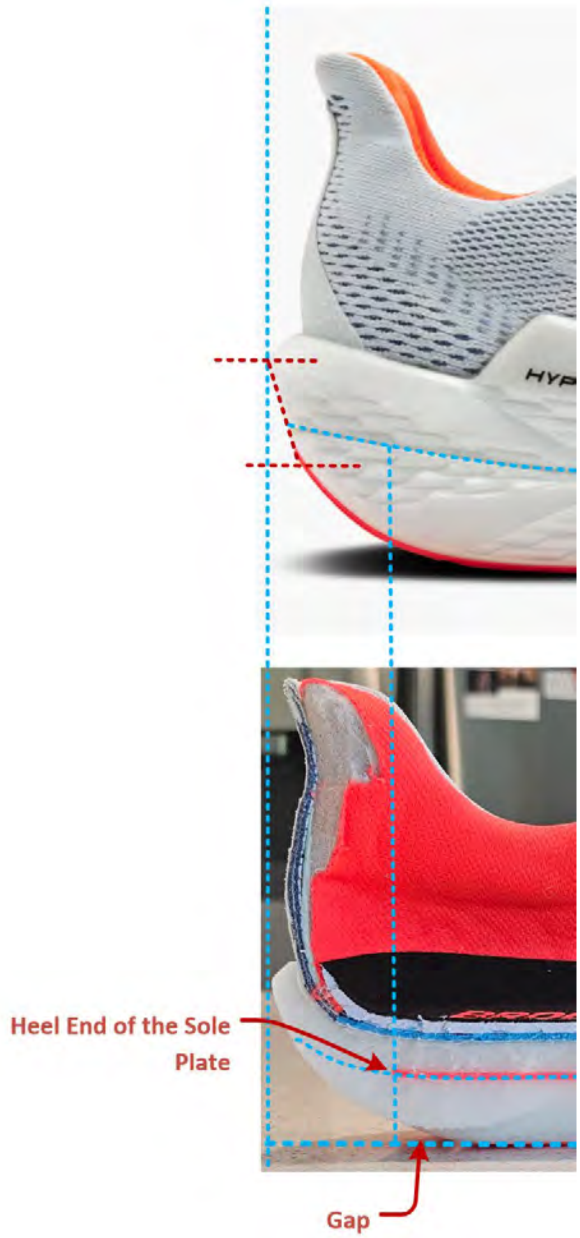
’816, Claim 1	Brooks Hyperion Max 2
and wherein the heel end of the sole plate is positioned over the gap	

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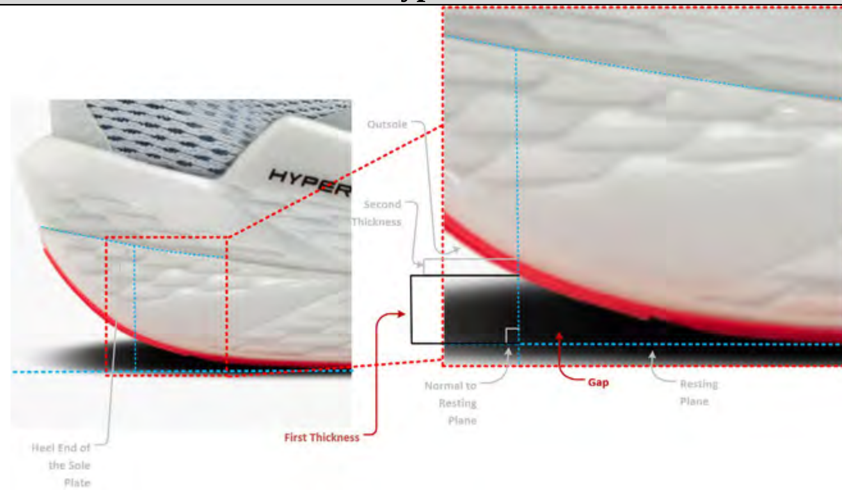
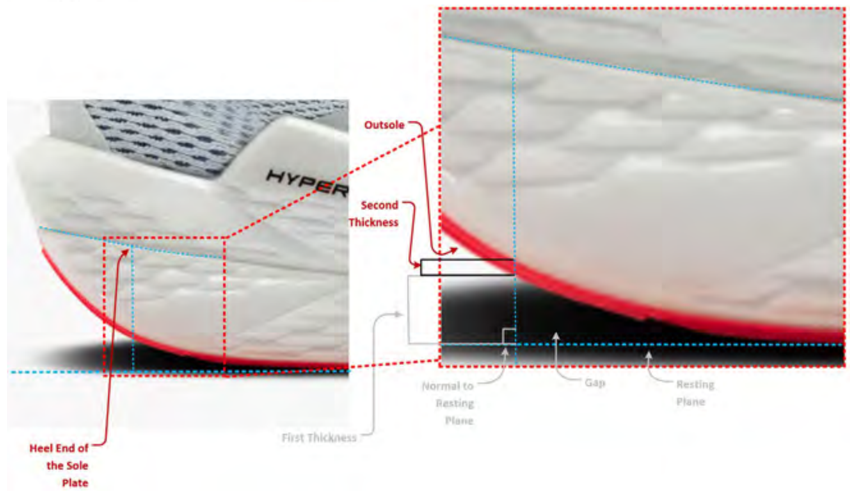
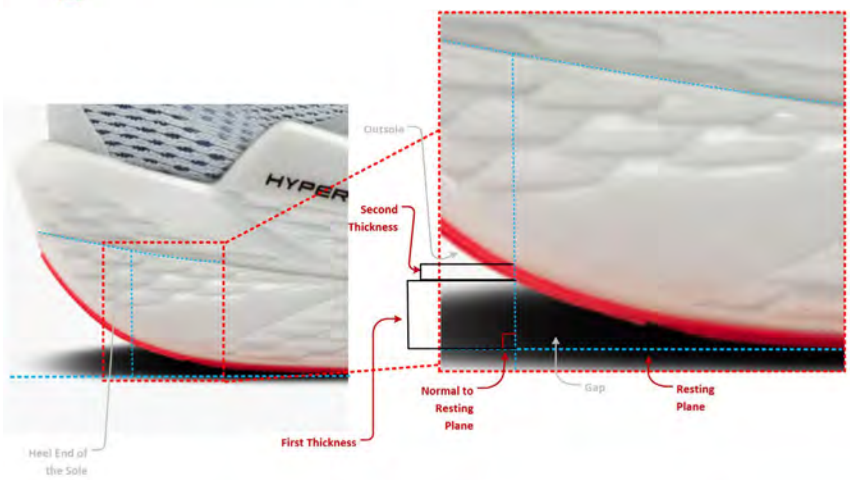
’816, Claim 1	Brooks Hyperion Max 2
where the gap has a first thickness that is greater than a second thickness of the outsole at the heel end of the sole plate, each of the first thickness and the second thickness taken along a direction that is normal to the resting plane.	  

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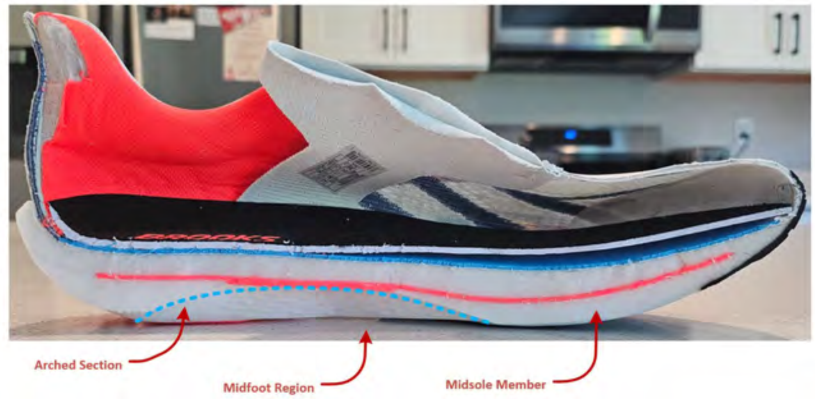
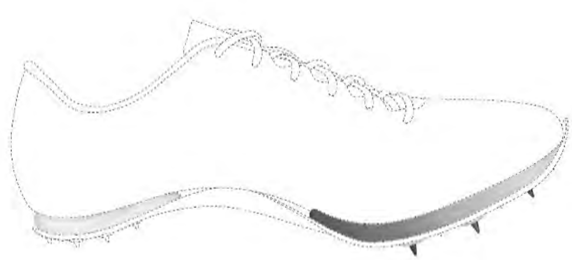
’816, Claim 18	Brooks Hyperion Max 2
The sole structure of claim 1, wherein the midsole member includes an arched section in a midfoot region.	

38. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the D’421 Patent. A true and correct copy of the D’421 Patent is attached hereto as Exhibit E.

39. After the priority date of the D’421 Patent, Brooks introduced the Hyperion Elite MD.

40. The Hyperion Elite MD infringes the D’421 Patent. As shown below, the Hyperion Elite MD meets every limitation of the D’421 Patent.

U.S. D1,022,421	Hyperion Elite MD
 FIG. 1	
 FIG. 2	

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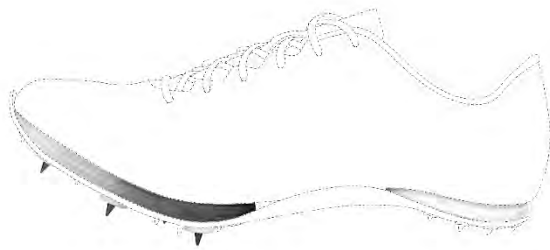
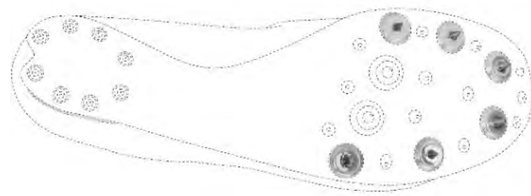
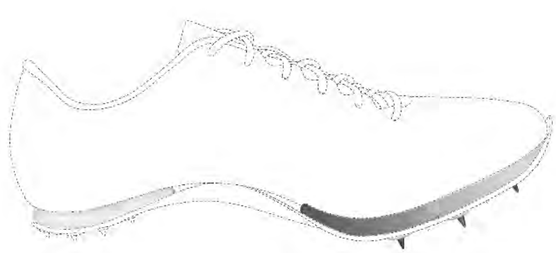
U.S. D1,022,421	Hyperion Elite MD
 FIG. 3	
 FIG. 4	

41. After the priority date of the D'421 Patent, Brooks introduced the Hyperion Elite LD.

42. The Hyperion Elite LD infringes the D'421 Patent. As shown below, the Hyperion Elite LD meets every limitation of the D'421 Patent.

U.S. D1,022,421	Hyperion Elite LD
 FIG. 1	
 FIG. 2	

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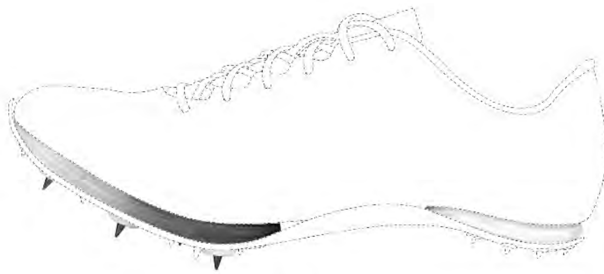
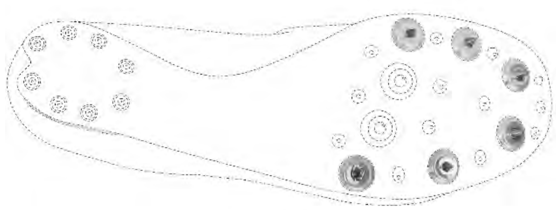
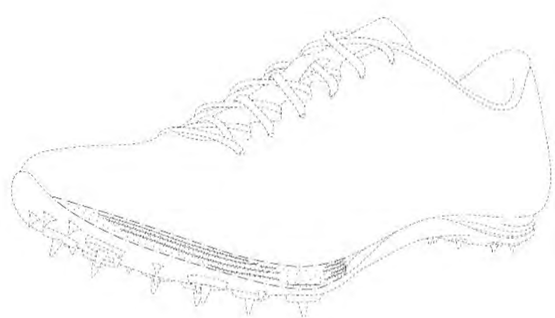
U.S. D1,022,421	Hyperion Elite LD
 FIG. 3	
 FIG. 4	

43. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the D’422 Patent. A true and correct copy of the D’422 Patent is attached hereto as Exhibit F.

44. After the priority date of the D’422 Patent, Brooks introduced the Hyperion Elite MD.

45. The Hyperion Elite MD infringes the D’422 Patent. As shown below, the Hyperion Elite MD meets every limitation of the D’422 Patent.

U.S. D1,022,422	Hyperion Elite MD
 FIG. 1	

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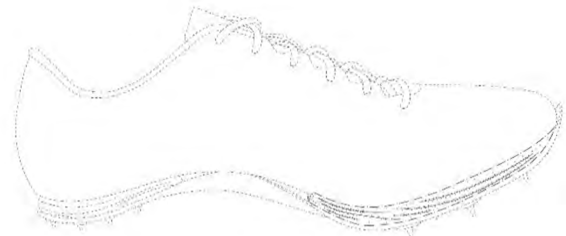
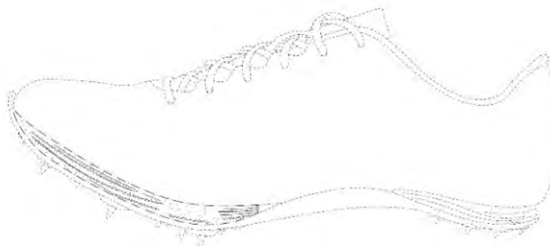
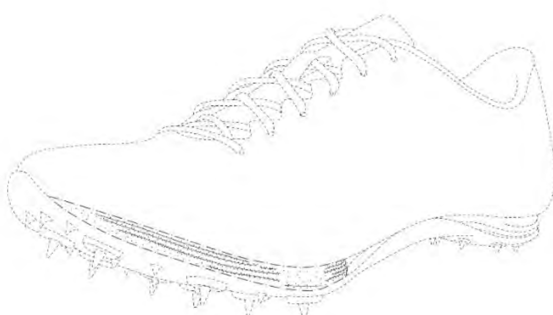
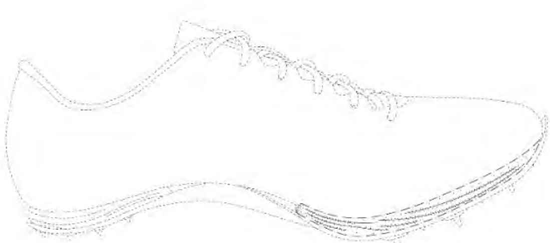
U.S. D1,022,422	Hyperion Elite MD
 FIG. 2	
 FIG. 3	

46. After the priority date of the D'422 Patent, Brooks introduced the Hyperion Elite LD.

47. The Hyperion Elite LD infringes the D'422 Patent. As shown below, the Hyperion Elite LD meets every limitation of the D'422 Patent.

U.S. D1,022,422	Hyperion Elite LD
 FIG. 1	
 FIG. 2	

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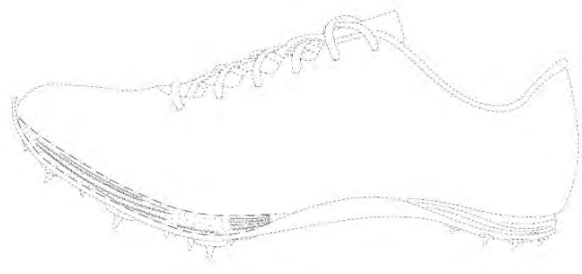
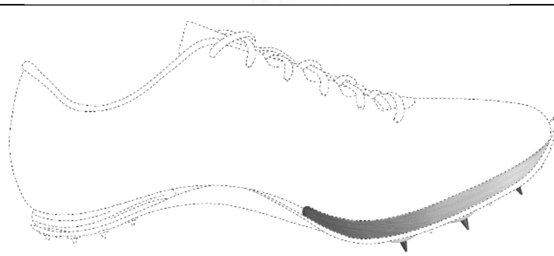
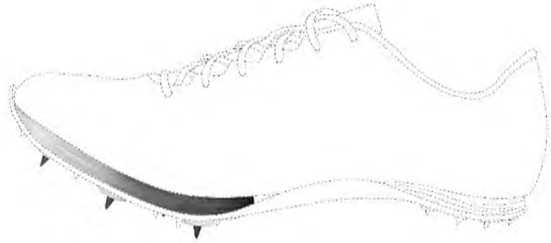
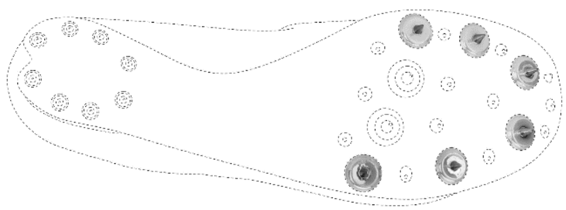
U.S. D1,022,422	Hyperion Elite LD
 FIG. 3	

48. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the D'531 Patent. A true and correct copy of the '531 Patent is attached hereto as Exhibit G.

49. After the priority date of the D'531 Patent, Brooks introduced the Hyperion Elite MD.

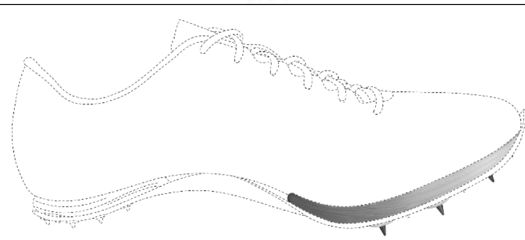
50. The Hyperion Elite MD infringes the D'531 Patent. As shown below, the Hyperion Elite MD meets every limitation of the D'531 Patent.

U.S. D1,023,531	Hyperion Elite MD
 FIG. 1	
 FIG. 2	

U.S. D1,023,531	**Hyperion Elite MD**
 FIG. 3	
 FIG. 4	

51. After the priority date of the D’531 Patent, Brooks introduced the Hyperion Elite LD.

52. The Hyperion Elite LD infringes the D’531 Patent. As shown below, the Hyperion Elite LD meets every limitation of the D’531 Patent.

U.S. D1,023,531	**Hyperion Elite LD**
 FIG. 1	
 FIG. 2	

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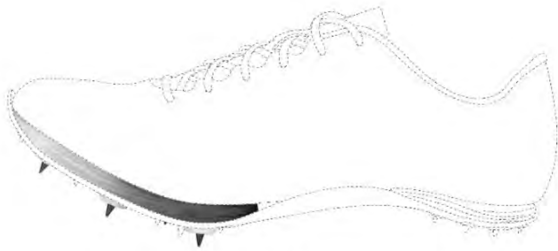
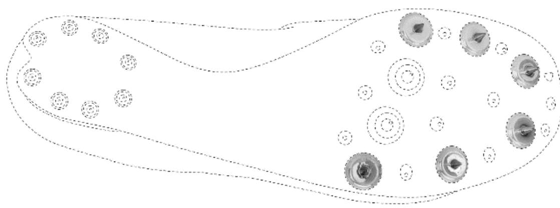
U.S. D1,023,531	Hyperion Elite LD
 FIG. 3	
 FIG. 4	

53. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the D'356 Patent. A true and correct copy of the D'356 Patent is attached hereto as Exhibit H.

54. After the priority date of the D'356 Patent, Brooks introduced the Hyperion Elite 4.

55. The Hyperion Elite 4 infringes the D'356 Patent. As shown below, the Hyperion Elite 4 meets every limitation of the D'356 Patent.

U.S. D1,021,356	Hyperion Elite 4
 FIG. 1	

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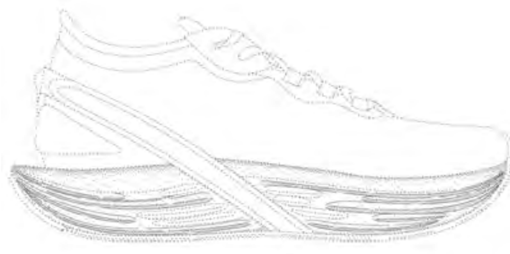
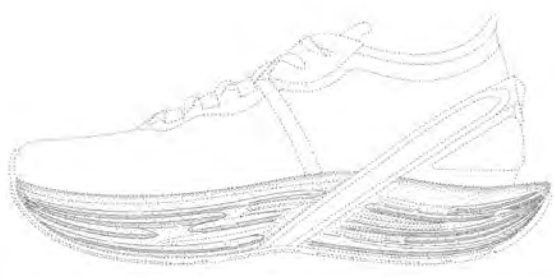
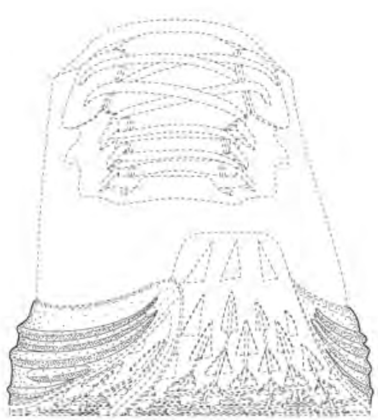
U.S. D1,021,356	Hyperion Elite 4
 FIG. 2	
 FIG. 3	
 FIG. 4	

56. Plaintiff PUMA SE is the owner by assignment of the entire right, title, and interest in the D’432 Patent. A true and correct copy of the D’432 Patent is attached hereto as Exhibit I.

57. After the priority date of the D’432 Patent, Brooks introduced the Hyperion Elite 4.

58. The Hyperion Elite 4 infringes the D’432 Patent. As shown below, the Hyperion Elite 4 meets every limitation of the D’432 Patent.

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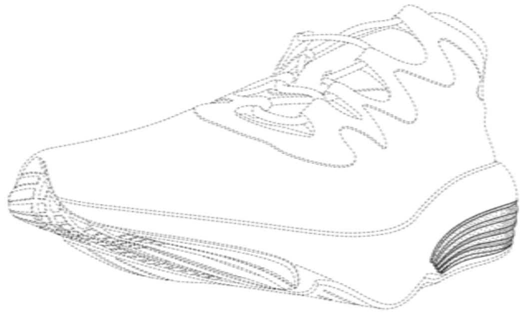
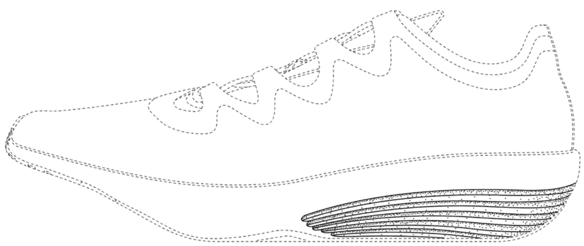
U.S. D1,009,432	Hyperion Elite 4
 FIG. 1	
 FIG. 2	

59. Brooks' routine practice of infringing PUMA's intellectual property is willful, deliberate, and intentional. Brooks' complete disregard for PUMA's intellectual property will continue to irreparably harm PUMA unless enjoined by this Court.

CAUSES OF ACTION

COUNT I:

Infringement of U.S. Patent No. 11,825,904

60. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

61. Under 35 U.S.C. § 271(a), Brooks has directly infringed and continues to directly infringe, literally or under the doctrine of equivalents, PUMA's '904 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that meets every limitation of at least Claim 14 of the '904 Patent.

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62. At least as January 2024, Brooks has knowledge of the ’904 Patent and of Brooks’ infringement thereof.

63. At least as of January 2024, Brooks’ infringement of the ’904 Patent has been willful.

64. At least as of January 2024, Brooks has actively induced others to directly infringe the ’904 Patent.

65. PUMA has sustained damages as a direct and proximate result of Defendant’s infringement of the ’904 Patent and is entitled to damages pursuant to 35 U.S.C. § 284.

66. Brooks’ infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT II:

Infringement of U.S. Patent No. 11,974,629

67. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

68. Under 35 U.S.C. § 271(a), Brooks has directly infringed and continues to directly infringe, literally or under the doctrine of equivalents, PUMA’s ’629 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that meets every limitation of at least Claim 1 of the ’629 Patent.

69. At least as of the filing of the Complaint, Brooks has knowledge of the ’629 Patent and of Brooks’ infringement thereof.

70. At least as of the filing of the Complaint, Brooks’ infringement of the ’629 Patent has been willful.

71. At least as of the filing of the Complaint, Brooks has actively induced others to directly infringe the ’629 Patent.

72. PUMA has sustained damages as a direct and proximate result of Defendant’s infringement of the ’629 Patent and is entitled to damages pursuant to 35 U.S.C. § 284.

73. Brooks’ infringement has caused, and unless enjoined by this Court under 35

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U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT III:

Infringement of U.S. Patent No. 11,974,630

74. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

75. Under 35 U.S.C. § 271(a), Brooks has directly infringed and continues to directly infringe, literally or under the doctrine of equivalents, PUMA's '630 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that meets every limitation of at least Claim 15 of the '630 Patent.

76. At least as of the filing of the Complaint, Brooks has knowledge of the '630 Patent and of Brooks' infringement thereof.

77. At least as of the filing of the Complaint, Brooks' infringement of the '630 Patent has been willful.

78. At least as of the filing of the Complaint, Brooks has actively induced others to directly infringe the '630 Patent.

79. PUMA has sustained damages as a direct and proximate result of Defendant's infringement of the '630 Patent and is entitled to damages pursuant to 35 U.S.C. § 284.

80. Brooks' infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT IV:

Infringement of U.S. Patent No. 12,016,422

81. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

82. Under 35 U.S.C. § 271(a), Brooks has directly infringed and continues to directly infringe, literally or under the doctrine of equivalents, PUMA's '422 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, one or more

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shoes that meet every limitation of at least Claim 9 of the ’422 Patent.

83. At least as of the filing of the Complaint, Brooks has knowledge of the ’422 Patent and of Brooks’ infringement thereof.

84. At least as of the filing of the Complaint, Brooks’ infringement of the ’422 Patent has been willful.

85. At least as of the filing of the Complaint, Brooks has actively induced others to directly infringe the ’422 Patent.

86. PUMA has sustained damages as a direct and proximate result of Defendant’s infringement of the ’422 Patent and is entitled to damages pursuant to 35 U.S.C. § 284.

87. Brooks’ infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT V:

Infringement of U.S. Patent No. 12,096,816

88. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

89. Under 35 U.S.C. § 271(a), Brooks has directly infringed and continues to directly infringe, literally or under the doctrine of equivalents, PUMA’s ’816 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, one or more shoes that meet every limitation of at least Claim 18 of the ’816 Patent.

90. At least as of the filing of this First Amended Complaint, Brooks has knowledge of the ’816 Patent and of Brooks’ infringement thereof.

91. At least as of the filing of this First Amended Complaint, Brooks’ infringement of the ’816 Patent has been willful.

92. At least as of the filing of this First Amended Complaint, Brooks has actively induced others to directly infringe the ’816 Patent.

93. PUMA has sustained damages as a direct and proximate result of Defendant’s

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infringement of the ’816 Patent and is entitled to damages pursuant to 35 U.S.C. § 284.

94. Brooks’ infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT VI:

Design Patent Infringement of U.S. Patent No. D1,002,421

95. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

96. Under 35 U.S.C. § 271(a), Brooks has infringed and continues to infringe, literally or under the doctrine of equivalents, PUMA’s D’421 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that embodies the design covered by the D’421 Patent.

97. Brooks has profited from the sales of its Brooks Hyperion Elite MD.

98. Brooks has profited from the sales of its Brooks Hyperion Elite LD.

99. Brooks has profited from its infringement of the D’421 Patent.

100. PUMA has sustained damages as a direct and proximate result of Brooks’ infringement of the D’421 Patent and is entitled to damages pursuant to 35 U.S.C. §§ 284 and 289.

101. Brooks’ infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT VII:

Design Patent Infringement of U.S. Patent No. D1,002,422

102. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

103. Under 35 U.S.C. § 271(a), Brooks has infringed and continues to infringe, literally or under the doctrine of equivalents, PUMA’s D’422 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that embodies the

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design covered by the D’422 Patent.

104. Brooks has profited from the sales of its Brooks Hyperion Elite MD.

105. Brooks as profited from the sales of its Brooks Hyperion Elite LD.

106. Brooks has profited from its infringement of the D’422 Patent.

107. PUMA has sustained damages as a direct and proximate result of Brooks’ infringement of the D’422 Patent and is entitled to damages pursuant to 35 U.S.C. §§ 284 and 289.

108. Brooks’ infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT VIII:

Design Patent Infringement of U.S. Patent No. D1,023,531

109. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

110. Under 35 U.S.C. § 271(a), Brooks has infringed and continues to infringe, literally or under the doctrine of equivalents, PUMA’s D’531 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that embodies the design covered by the D’531 Patent.

111. Brooks has profited from the sales of its Brooks Hyperion Elite MD.

112. Brooks has profited from the sales of its Brooks Hyperion Elite LD.

113. Brooks has profited from its infringement of the D’531 Patent.

114. PUMA has sustained damages as a direct and proximate result of Brooks’ infringement of the D’531 Patent and is entitled to damages pursuant to 35 U.S.C. §§ 284 and 289.

115. Brooks’ infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

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COUNT IX:

Design Patent Infringement of U.S. Patent No. D1,021,356

116. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

117. Under 35 U.S.C. § 271(a), Brooks has infringed and continues to infringe, literally or under the doctrine of equivalents, PUMA's D'356 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that embodies the design covered by the D'356 Patent.

118. Brooks has profited from its sales of its Hyperion Elite 4.

119. Brooks has profited from its infringement of the D'356 Patent.

120. PUMA has sustained damages as a direct and proximate result of Brooks' infringement of the D'356 Patent and is entitled to damages pursuant to 35 U.S.C. §§ 284 and 289.

121. Brooks' infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

COUNT X:

Design Patent Infringement of U.S. Patent No. D1,009,432

122. PUMA incorporates by reference the allegations contained in the preceding paragraphs as if separately repeated here.

123. Under 35 U.S.C. § 271(a), Brooks has infringed and continues to infringe, literally or under the doctrine of equivalents, PUMA's D'432 Patent by making, using, selling, and offering for sale in the United States, or importing into the United States, a shoe that embodies the design covered by the D'432 Patent.

124. Brooks has profited from its sales of its Hyperion Elite 4.

125. Brooks has profited from its infringement of the D'432 Patent.

126. PUMA has sustained damages as a direct and proximate result of Brooks' infringement of the D'432 Patent and is entitled to damages pursuant to 35 U.S.C. §§ 284 and

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289.

127. Brooks' infringement has caused, and unless enjoined by this Court under 35 U.S.C. § 283, will continue to cause PUMA to suffer irreparable harm for which it cannot be adequately compensated by a monetary award.

PRAYER FOR RELIEF

WHEREFORE, PUMA seeks the following relief:

A. An entry of judgment in PUMA's favor and against Brooks on all Counts of this First Amended Complaint;

B. An order enjoining, temporarily, preliminarily and permanently, Brooks, and each of its respective officers, agents, servants, employees, and attorneys, and all of those persons in active concert or participation with it, from infringing any of the Asserted Patents;

C. An award of damages adequate to compensate PUMA for the patent infringement that has occurred pursuant to 35 U.S.C. §§ 284 and 289, together with prejudgment interest and costs, treble damages for Brooks' willful infringement, and reasonable attorneys' fees, pursuant to 35 U.S.C. §§ 284 and 285;

D. An order declaring this an exceptional case and awarding PUMA its attorneys' fees and costs in accordance with 35 U.S.C. § 285; and

E. Such other relief as the Court may deem just and proper.

JURY DEMAND

PUMA demands a trial by jury on all issues properly tried to a jury.

Dated: November 8, 2024

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EXHIBIT A

US011825904B2

(12) **United States Patent**
Redon et al.

(10) **Patent No.: US 11,825,904 B2**
(45) **Date of Patent: Nov. 28, 2023**

(54) **ARTICLE OF FOOTWEAR HAVING A SOLE PLATE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

(72) Inventors: **Arnaud Redon**, Nuremberg (DE); **Romain Girard**, Lauf an der Pegnitz (DE)

(73) Assignee: **PUMA SE**, Herzogenaurach (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/114,670**

(22) Filed: **Feb. 27, 2023**

(65) **Prior Publication Data**

US 2023/0200489 A1 Jun. 29, 2023

Related U.S. Application Data

(63) Continuation of application No. 17/404,388, filed on Aug. 17, 2021, now Pat. No. 11,622,602.

(60) Provisional application No. 63/067,073, filed on Aug. 18, 2020.

(51) **Int. Cl.**
A43B 13/18 (2006.01)
A43B 13/04 (2006.01)

(52) **U.S. Cl.**
CPC ***A43B 13/186*** (2013.01); ***A43B 13/04*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,020,569 A		5/1977	Fukuoka	
4,542,598 A	*	9/1985	Misevich	A43B 13/16 36/31
5,052,130 A		10/1991	Barry et al.	
5,191,727 A		3/1993	Barry et al.	
5,315,769 A		5/1994	Barry et al.	
5,528,842 A		6/1996	Ricci et al.	
6,389,713 B1		5/2002	Kita	
D466,272 S		12/2002	Erickson	
D472,038 S		3/2003	Meynard	

(Continued)

FOREIGN PATENT DOCUMENTS

CN	111213958 A	6/2020
CN	212014663 U	11/2020

(Continued)

OTHER PUBLICATIONS

International Search Report and the Written Opinion of the International Searching Authority from corresponding PCT Application No. PCT/IB2021/057602 dated Nov. 12, 2021 (14 pages).

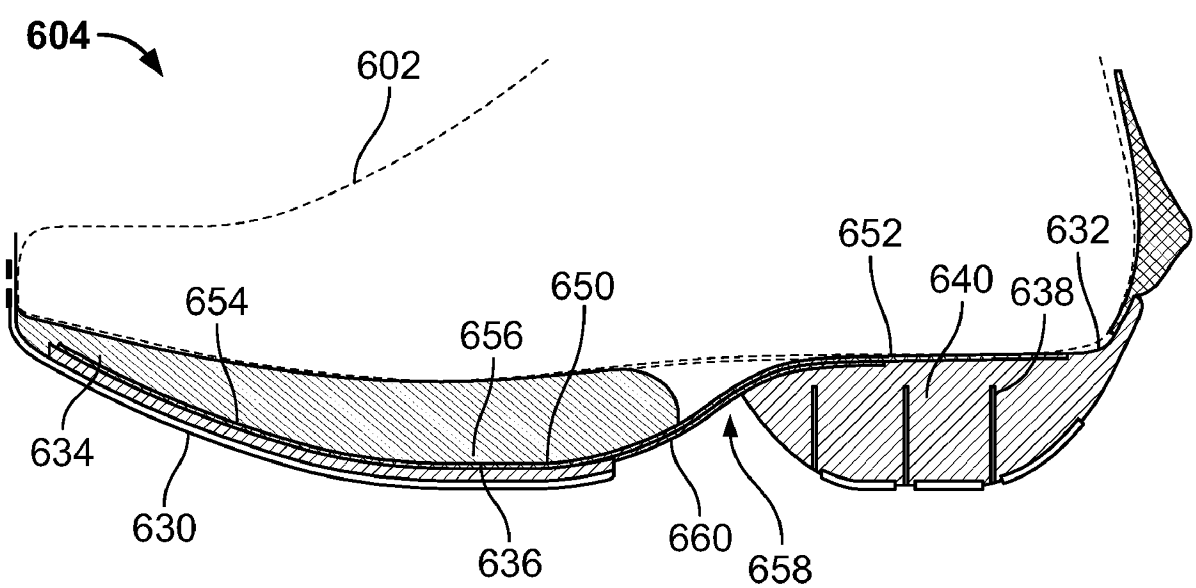
(Continued)

Primary Examiner — Jila M Mohandesi
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

(57) **ABSTRACT**

A sole structure for an article of footwear having an upper includes a first cushioning member disposed in a heel region of the sole structure and a second cushioning member disposed in a forefoot region of the sole structure. The second cushioning member is spaced apart from the first cushioning member by a gap that extends between the first cushioning member and the second cushioning member. A sole plate extends across the gap between the first cushioning member and the second cushioning member.

33 Claims, 41 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

6,625,905	B2 *	9/2003	Kita	A43B 13/12 36/28
D481,200	S	10/2003	Belley	
6,634,121	B2 *	10/2003	Sordi	A43B 13/141 36/31
6,662,469	B2	12/2003	Belley et al.	
D489,880	S	5/2004	McClaskie	
6,920,705	B2	7/2005	Lucas et al.	
7,401,422	B1	7/2008	Scholz et al.	
7,484,317	B2	2/2009	Kita et al.	
7,513,065	B2	4/2009	Kita et al.	
7,624,515	B2	12/2009	Kita et al.	
7,987,618	B2	8/2011	Nishiwaki et al.	
8,074,377	B2	12/2011	Nishiwaki et al.	
8,112,909	B2	2/2012	Kubo et al.	
8,387,279	B2	3/2013	Pauk et al.	
8,393,028	B2	3/2013	Namkook et al.	
8,418,379	B2	4/2013	Nishiwaki et al.	
D707,432	S	6/2014	Mochen	
8,850,718	B2 *	10/2014	Lubart	A43B 13/026 36/31
8,850,721	B2 *	10/2014	Long	A43B 7/22 36/107
9,572,398	B2	2/2017	Hurd et al.	
D783,960	S	4/2017	Hatfield	
D817,612	S	5/2018	Small	
10,010,137	B2 *	7/2018	Foxen	A43B 13/42
10,226,097	B2	3/2019	Farris et al.	
10,226,099	B2 *	3/2019	Bischoff	B29D 35/122
10,299,535	B2	5/2019	Hurd et al.	
D854,293	S	7/2019	Mokos	
D861,308	S	10/2019	Chang	
D863,744	S	10/2019	Della Valle	
D864,530	S	10/2019	Verfl	
10,448,701	B2	10/2019	Farris et al.	
D866,146	S	11/2019	Cass	
D872,983	S	1/2020	Louboutin	
10,524,536	B2	1/2020	Bunnell et al.	
D889,798	S	2/2020	Vella	
D890,496	S	2/2020	Le	
D877,465	S	3/2020	Hartmann	
D878,026	S	3/2020	Nikolic	
D879,437	S	3/2020	Brosseau	
D879,438	S	3/2020	Brosseau	
D885,729	S	6/2020	Swierszczyk	
D893,140	S	8/2020	Felloni	
D893,144	S	8/2020	Sfredda	
D895,244	S	9/2020	Felloni	
D897,082	S	9/2020	Belforti	
10,765,172	B2	9/2020	Foxen	
D898,331	S	10/2020	Taylor	
D899,038	S	10/2020	Thompson	
D900,458	S	11/2020	Swierszczyk	
D905,391	S	12/2020	Papp	
D905,938	S	12/2020	Sfredda	
D907,342	S	1/2021	Odinot	
D917,137	S	4/2021	Carson	
D918,548	S	5/2021	Bracalente	
D919,261	S	5/2021	Brosseau	
D919,262	S	5/2021	Brosseau	
D923,925	S	7/2021	Bramani	
11,089,834	B2 *	8/2021	Chambers	A43B 21/26
D937,549	S	12/2021	Della Valle	
D938,155	S	12/2021	Nikolic	
D943,883	S	2/2022	Bertelli	
D945,130	S	3/2022	Park	
D945,138	S	3/2022	Mitchell	
D957,097	S	7/2022	Park	
D969,469	S	11/2022	Redon	
11,622,602	B2 *	4/2023	Redon	A43B 13/125 36/28
2002/0078591	A1 *	6/2002	Morrone	A43B 5/12 36/102
2003/0079374	A1	5/2003	Belley	
2006/0137228	A1	6/2006	Kubo et al.	
2007/0101617	A1	5/2007	Brewer et al.	
2008/0052965	A1	3/2008	Sato	
2010/0218397	A1	9/2010	Nishiwaki et al.	
2011/0203137	A1	8/2011	Long	
2016/0029741	A1	2/2016	Foxen	
2016/0073734	A1	3/2016	Grabher et al.	
2017/0035143	A1	2/2017	Sato et al.	
2017/0079376	A1	3/2017	Bunnell et al.	
2018/0132564	A1 *	5/2018	Bruce	A43B 13/189
2018/0271215	A1	9/2018	Foxen	
2020/0008519	A1	1/2020	Farris et al.	
2020/0100564	A1	4/2020	Bunnell et al.	
2020/0100565	A1	4/2020	Yoshida et al.	
2020/0114634	A1 *	4/2020	Hensley	A43B 13/20
2022/0053879	A1	2/2022	Redon	
2022/0225729	A1	7/2022	Bonin	

FOREIGN PATENT DOCUMENTS

DE	4137350	A1	5/1993
DE	202013003797	U1	7/2013
EP	1346655	B1	8/2006
EP	1894484	B1	3/2018
EP	2911542	B1	12/2018
EP	3434132	A1	1/2019
EP	3174419	B1	7/2019
EP	3574791	A1	12/2019
EP	3316719	B1	5/2020
EP	3316721	B1	5/2020
KR	101057729	B1	8/2011
KR	20190075138	A	6/2019
WO	1995003719	A1	2/1995
WO	2011050720	A1	5/2011
WO	2012115343	A1	8/2012
WO	2017048934	A1	3/2017
WO	2017048937	A1	3/2017
WO	2017048938	A1	3/2017
WO	2017048939	A1	3/2017

OTHER PUBLICATIONS

Good Luck Trainer, ToryBurch.com, [online], [site visited Apr. 11, 2022]. URL: https://www.toryburch.com/en-eu/shoes/sneakers/good-luck-trainer/85463.html. (Year: 2022).

Beau Today Womens Chink Sneakers Platform Das Shoes for Women, Ubuy.com, [online], site visited Apr. 11, 2022]. URL: https://www.ubuy.com.tr/en/product/1IZIAHXK8-beau-today-women-s chunky-sneakers-platform-dad-shoes-for-women-beige-brown-us-6-5 (Year: 2022).

* cited by examiner

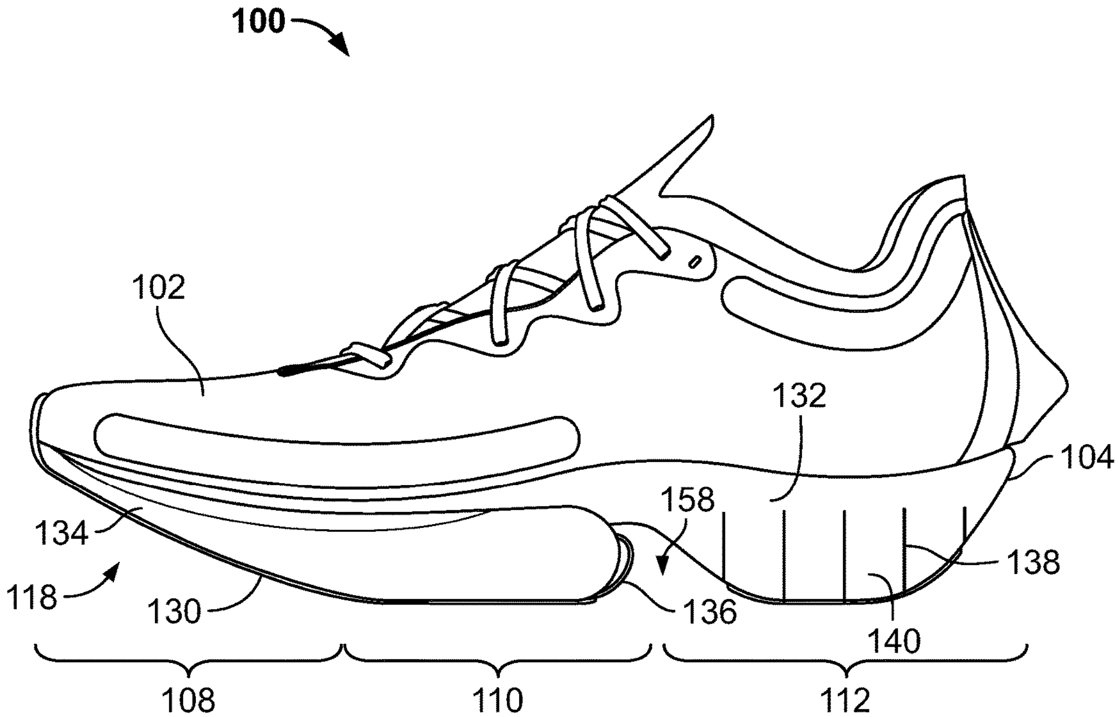

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FIG. 1

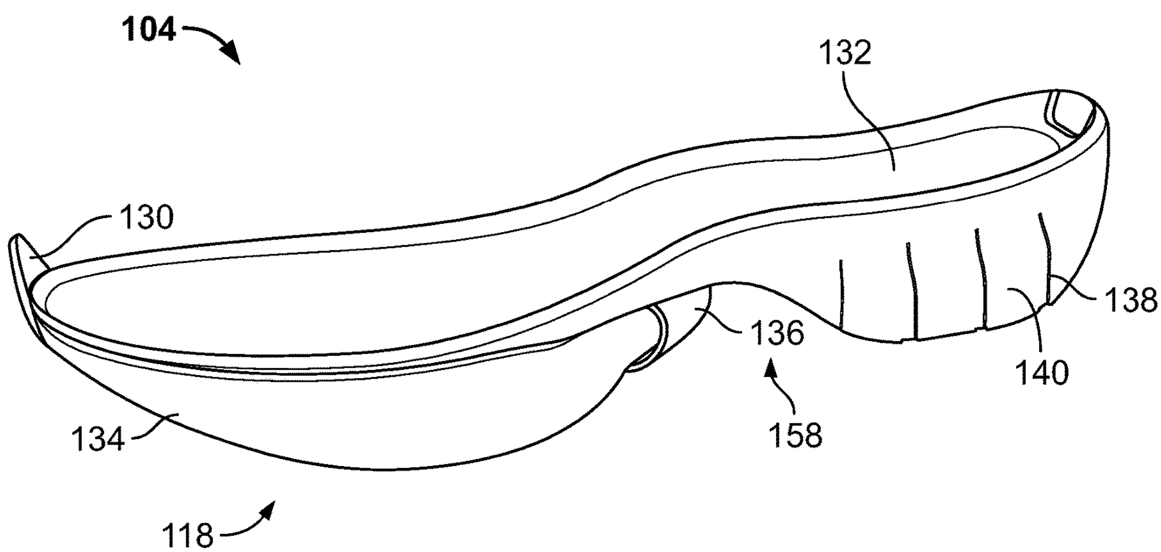
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FIG. 2

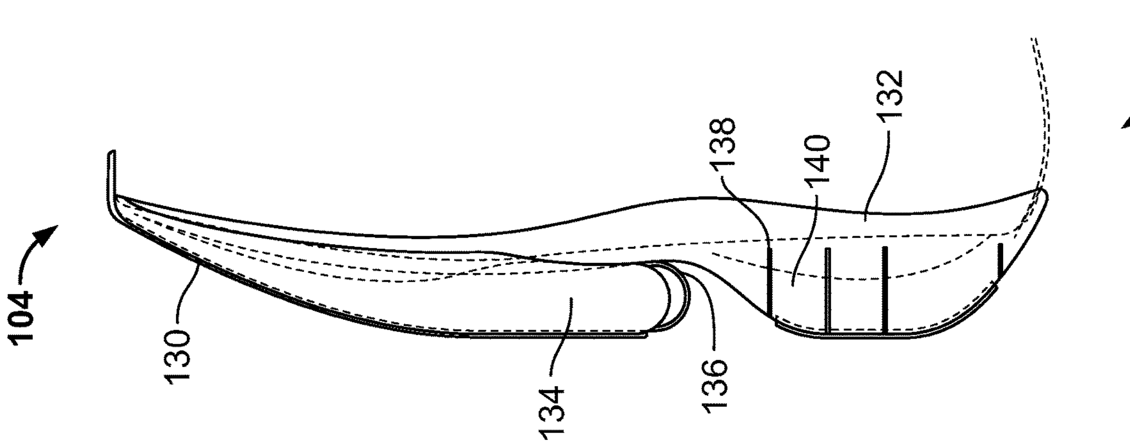


FIG. 3

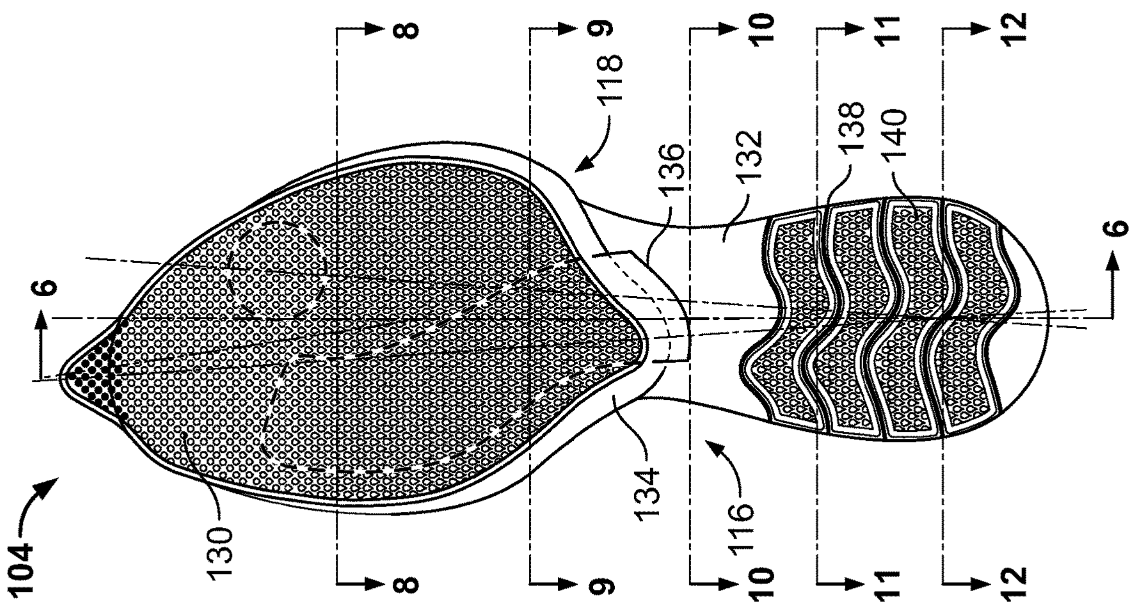
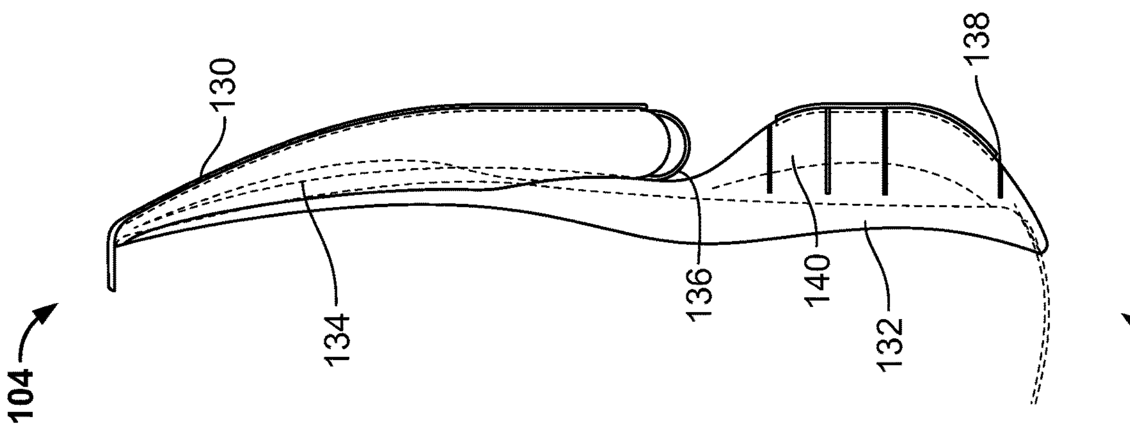


FIG. 4



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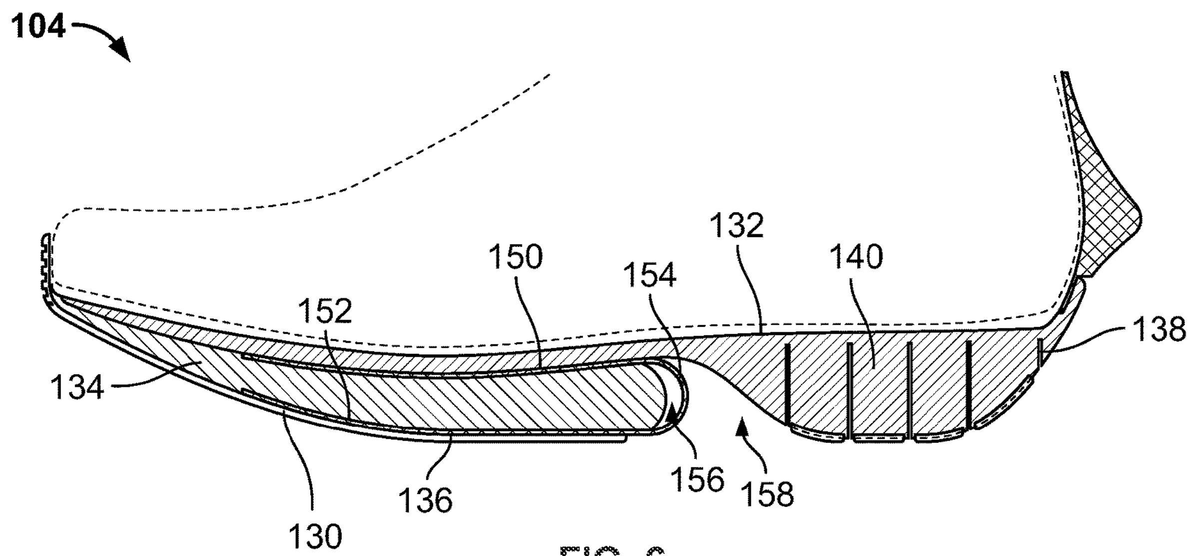
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FIG. 6

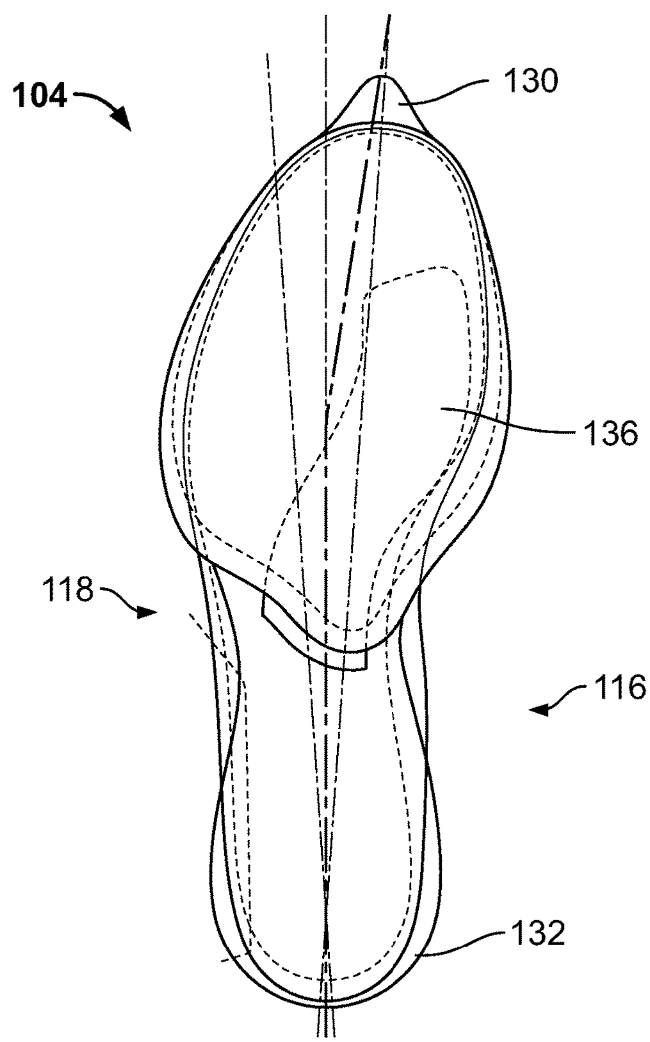
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FIG. 7

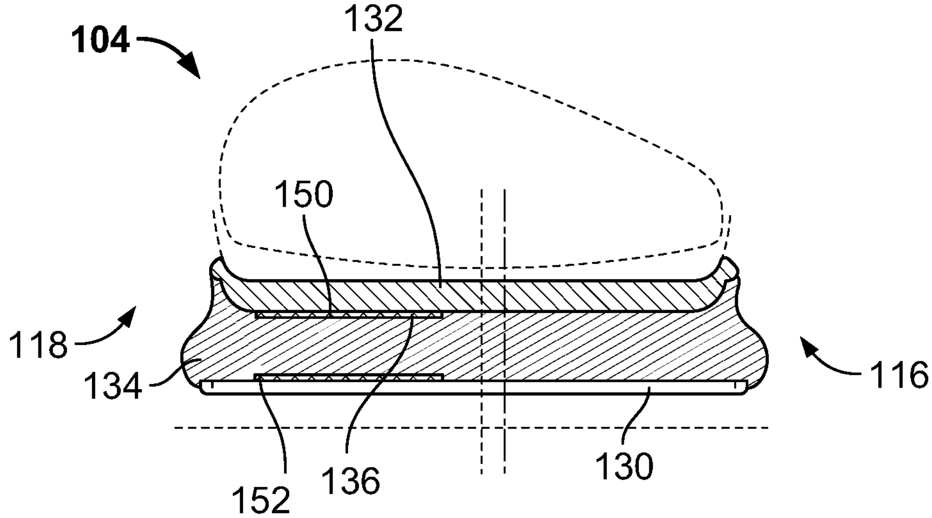
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FIG. 8

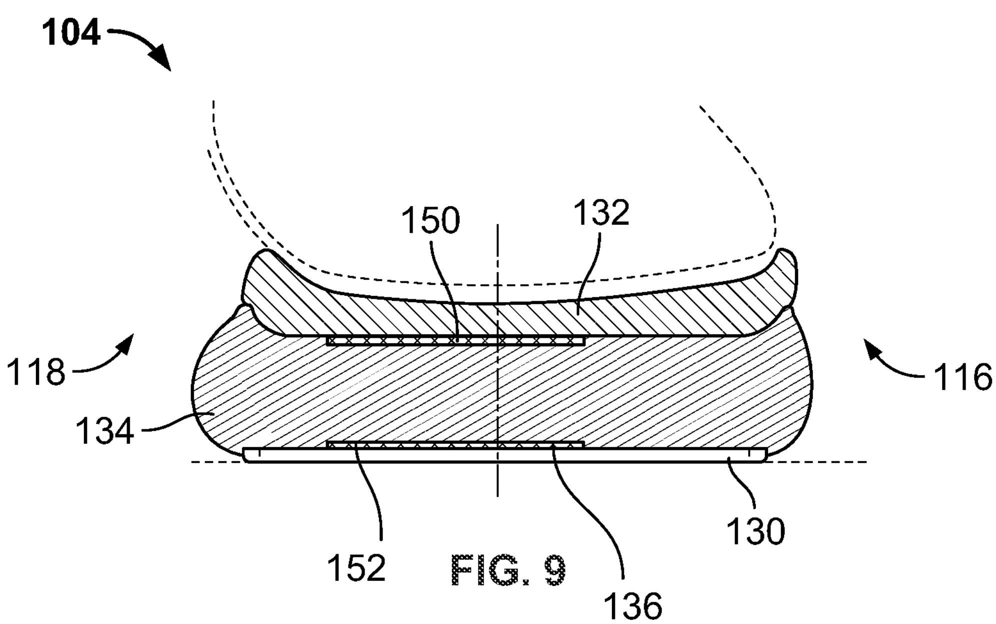
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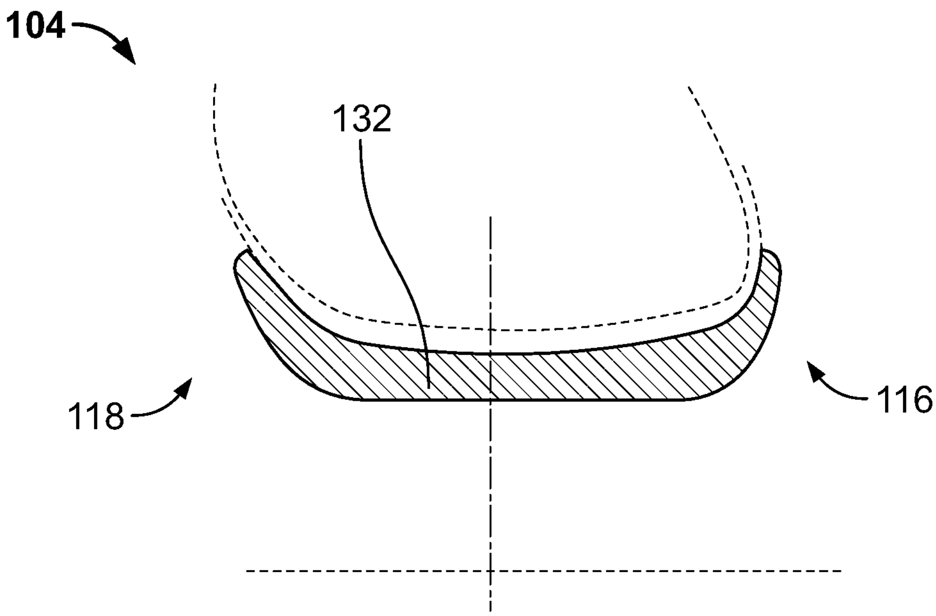
FIG. 9



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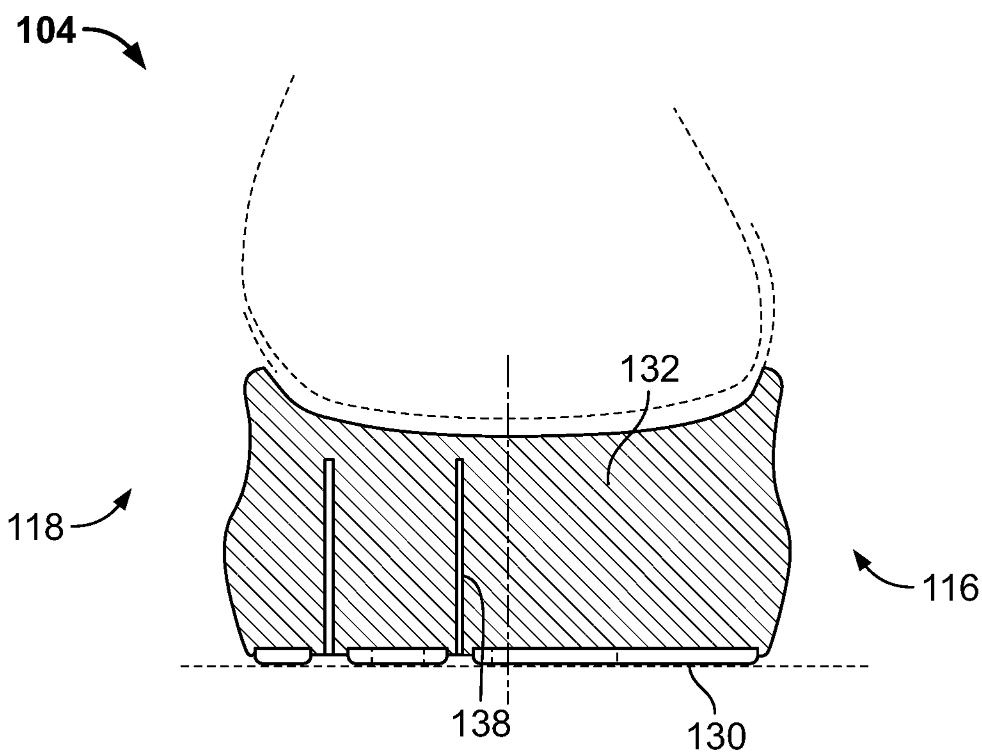

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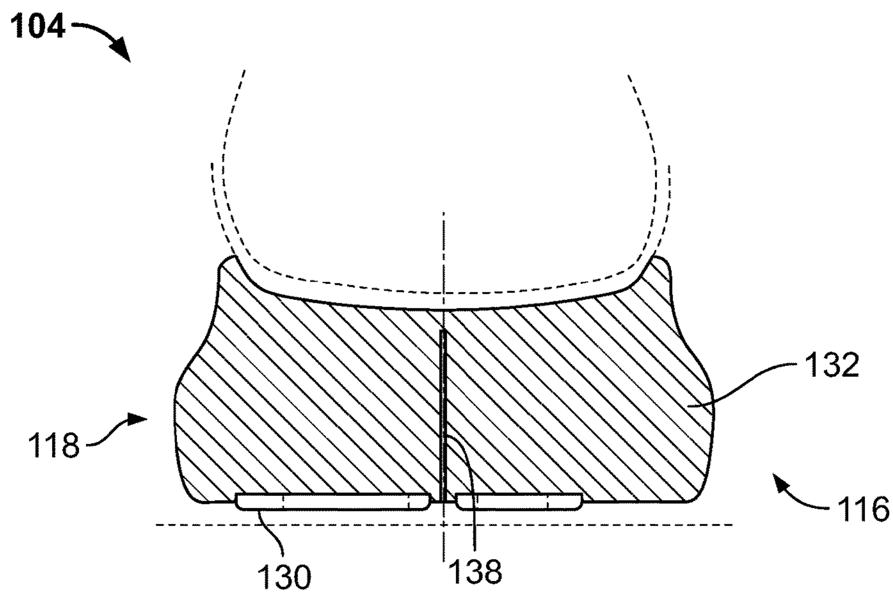

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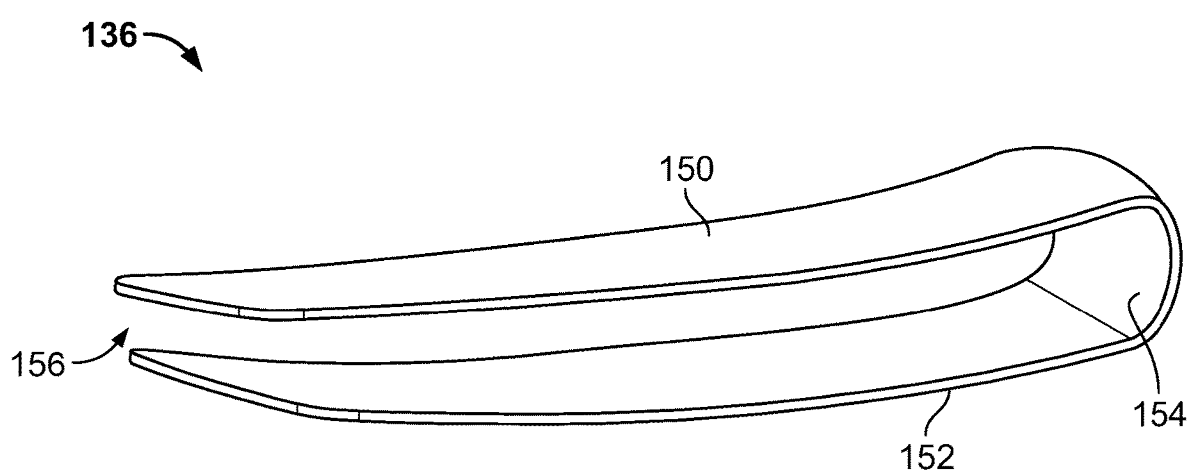

FIG. 13

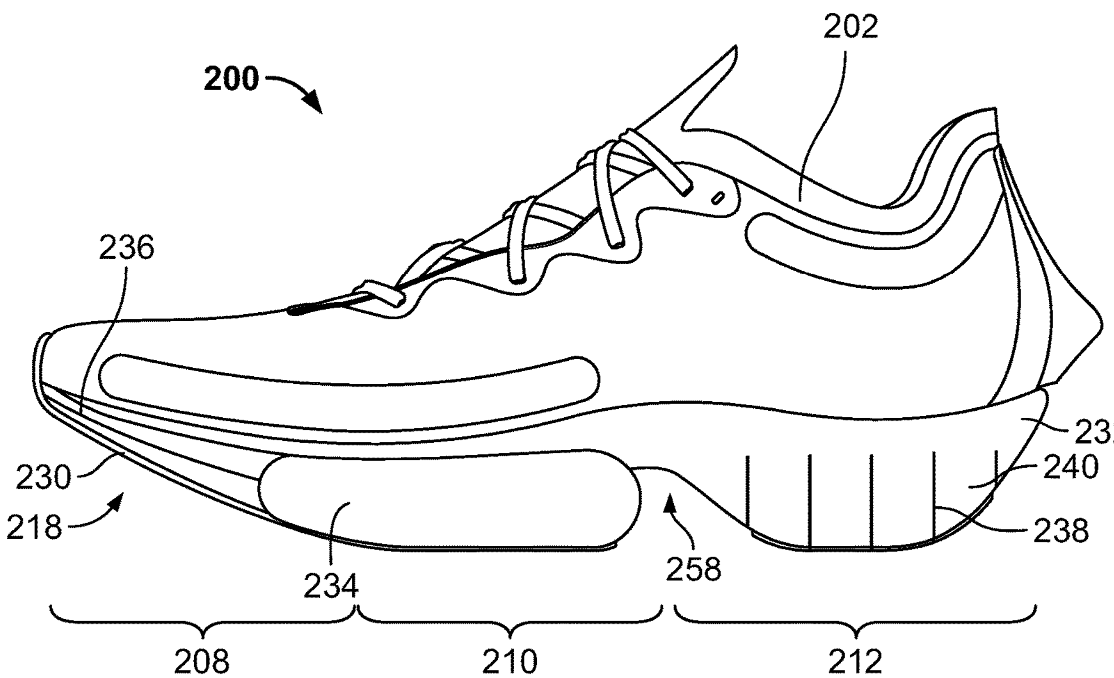
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FIG. 14

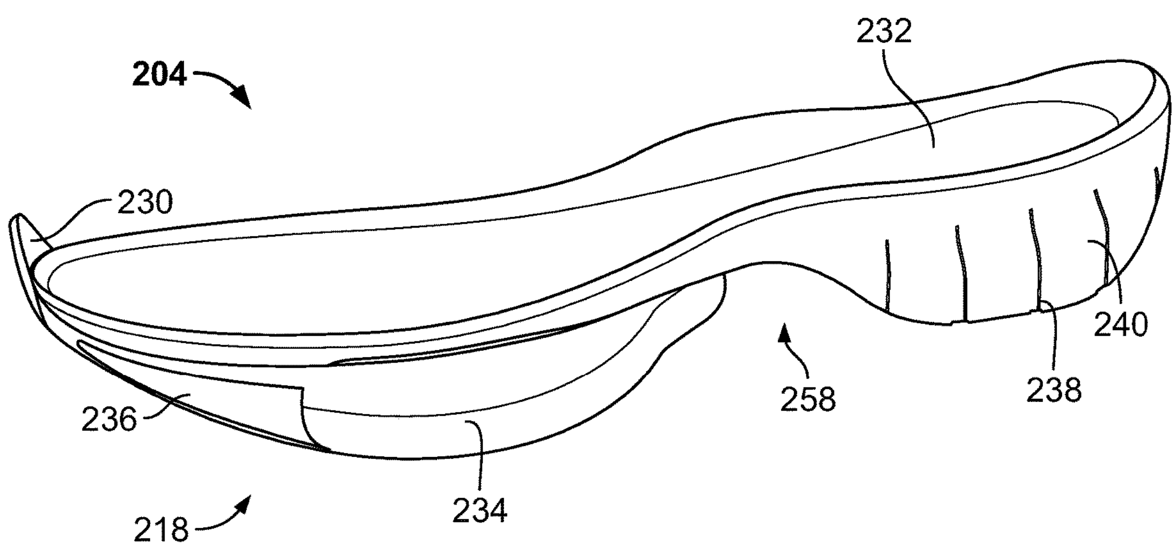
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FIG. 15

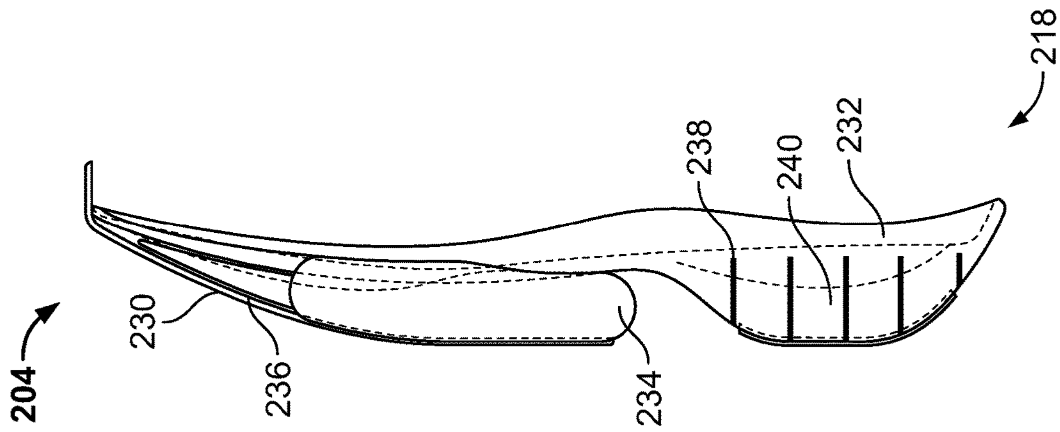

FIG. 16

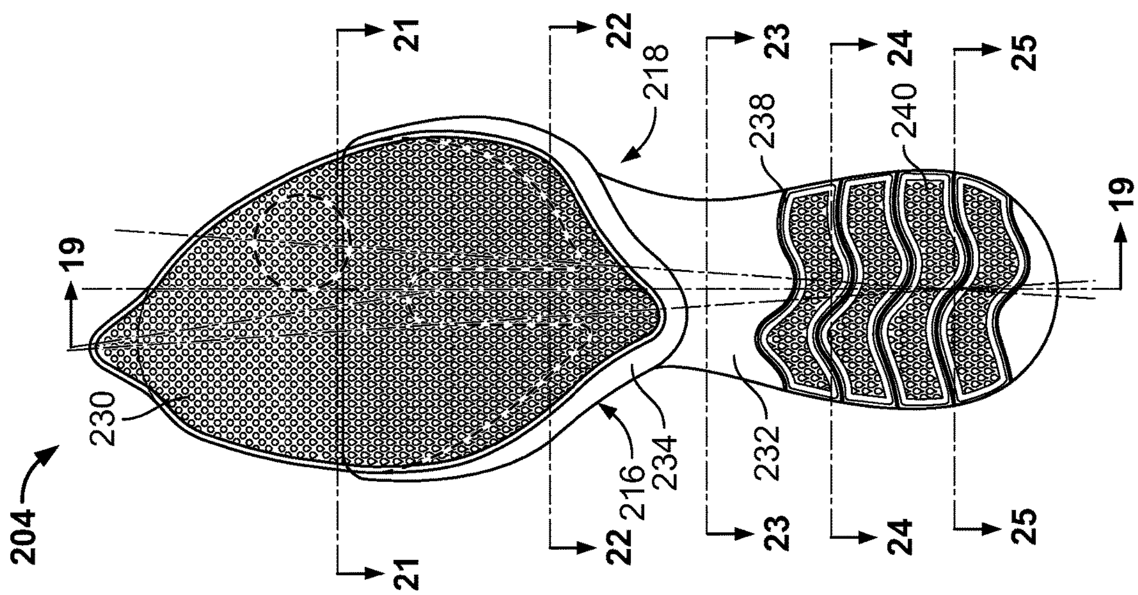

FIG. 17

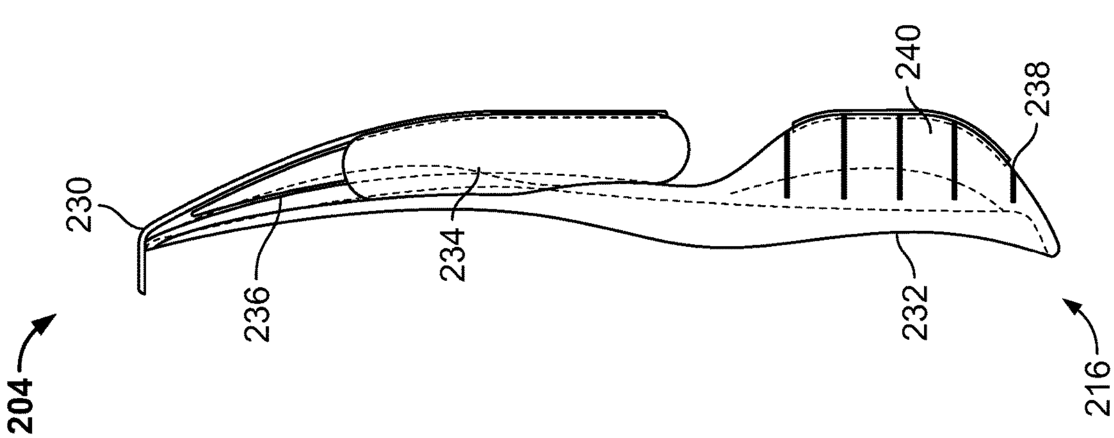

FIG. 18

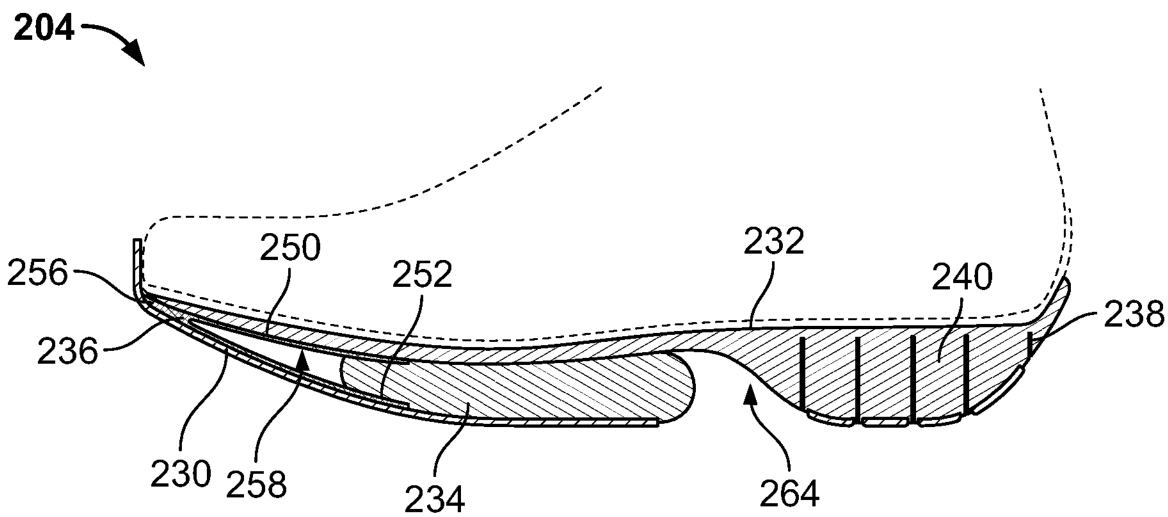

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FIG. 19

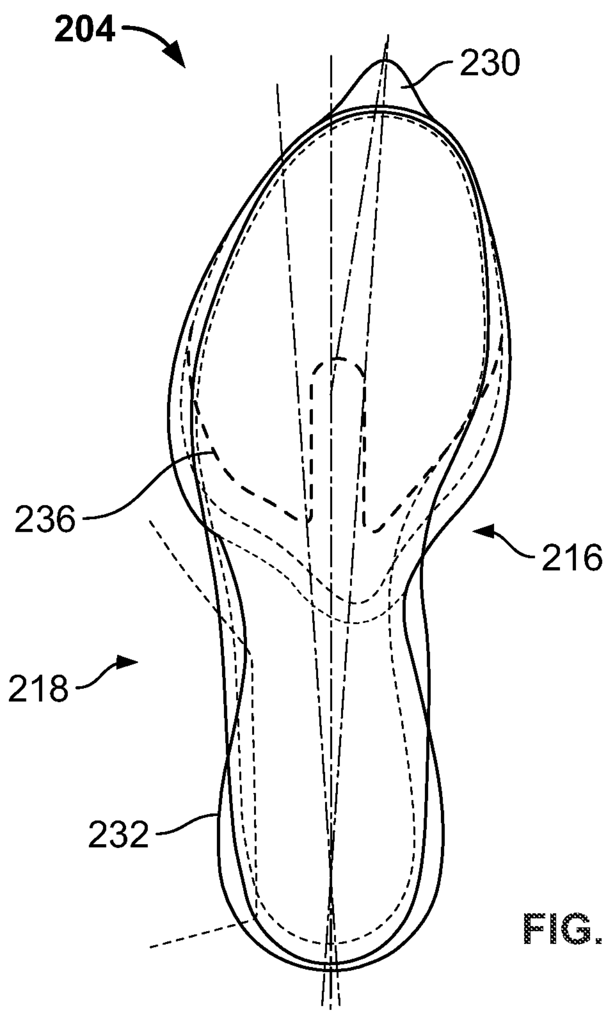

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FIG. 20

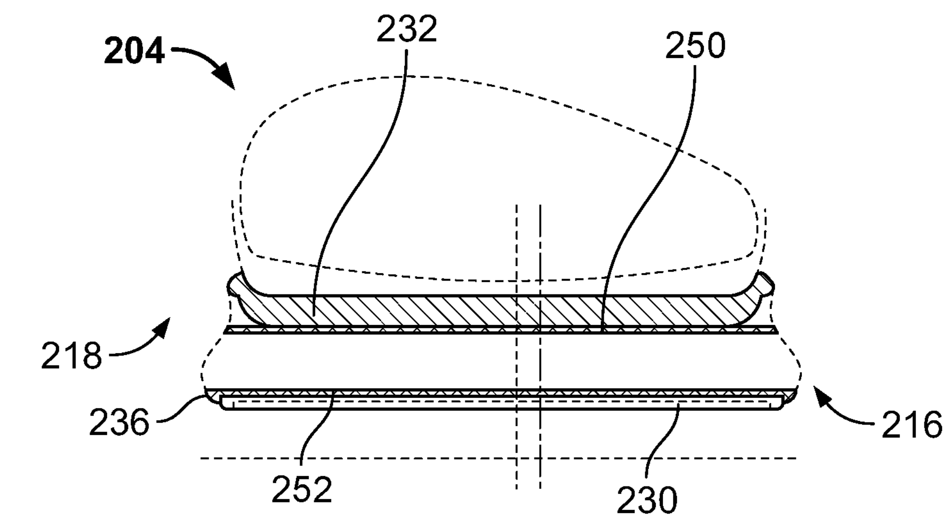
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FIG. 21

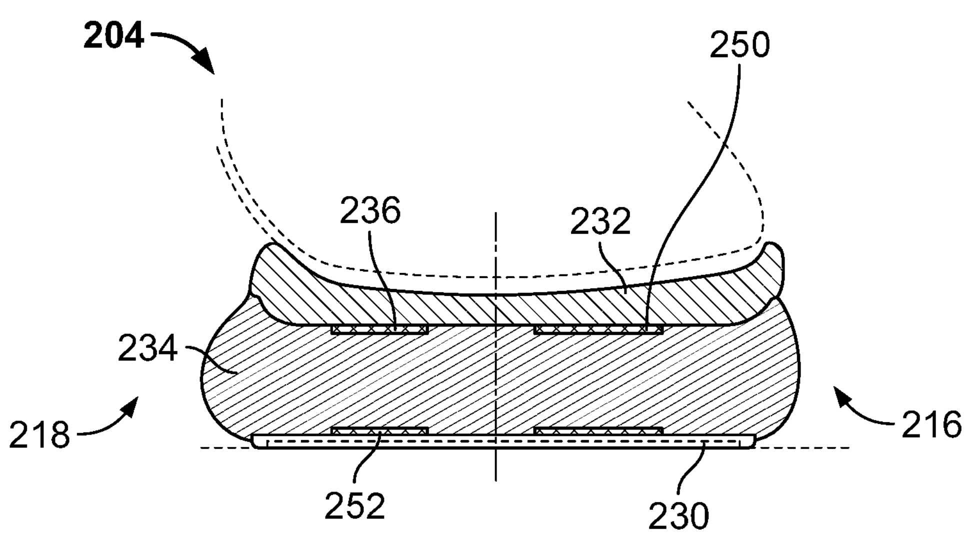
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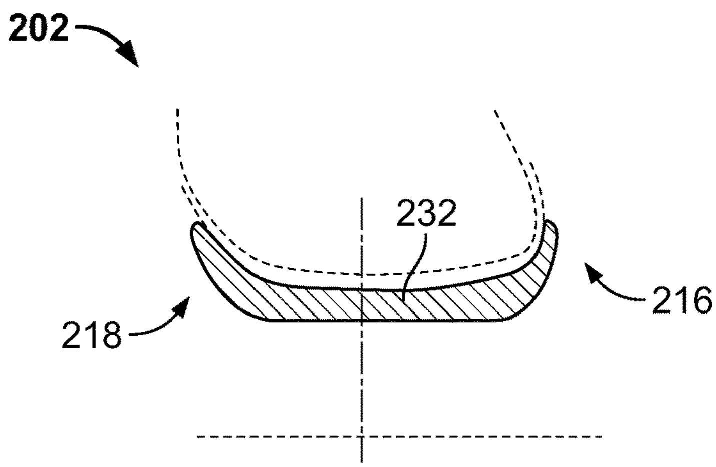
FIG. 22



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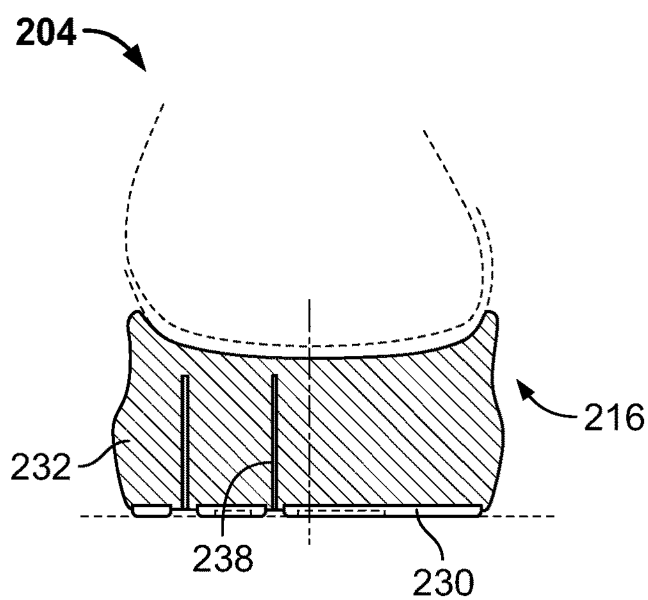

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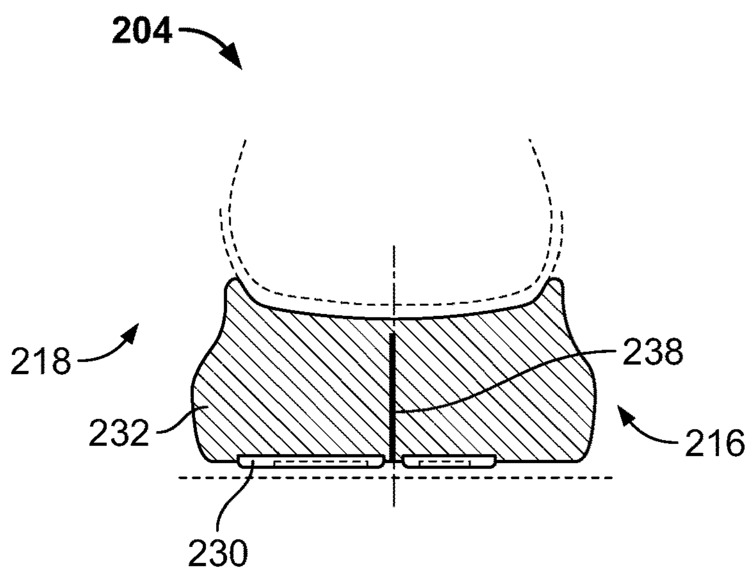

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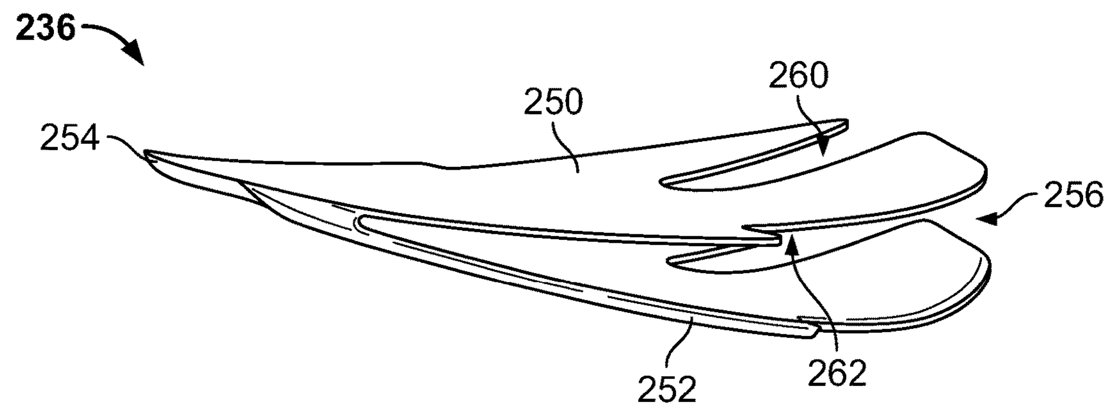

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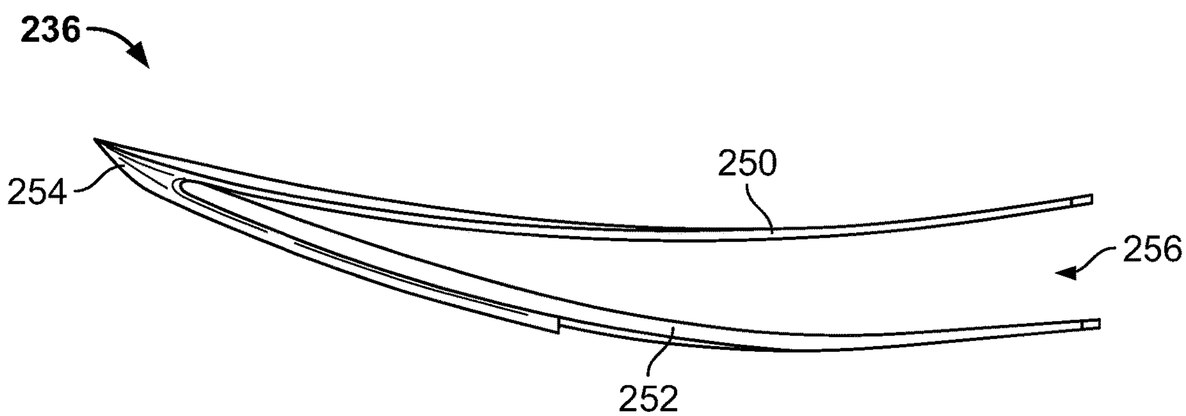

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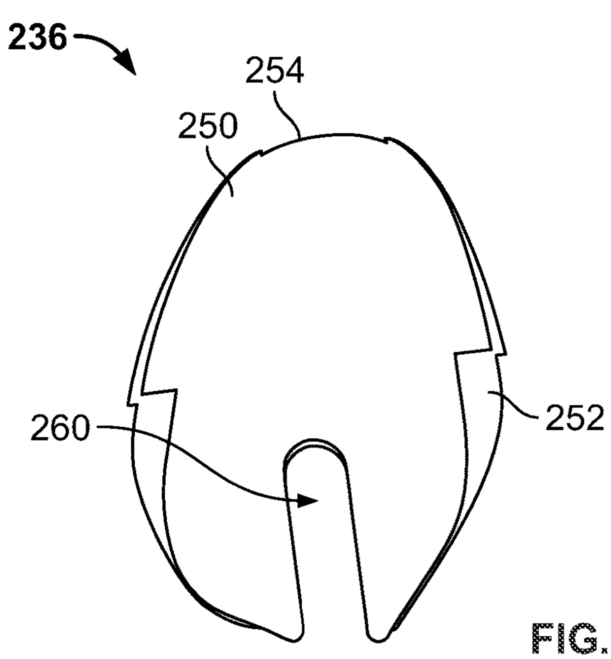

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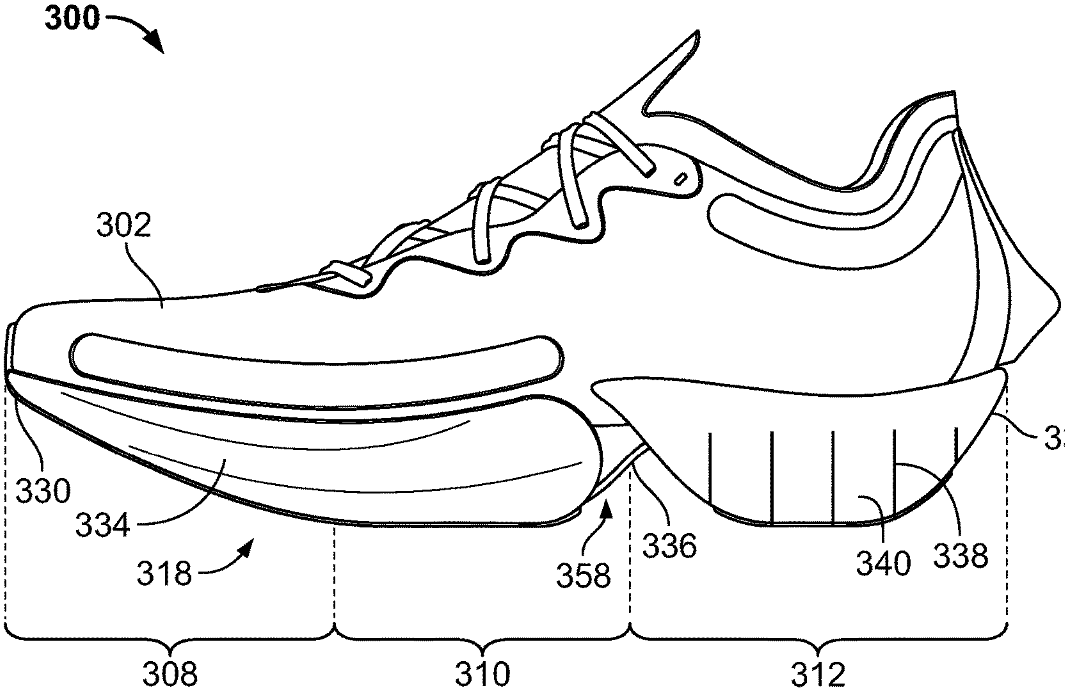
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FIG. 29

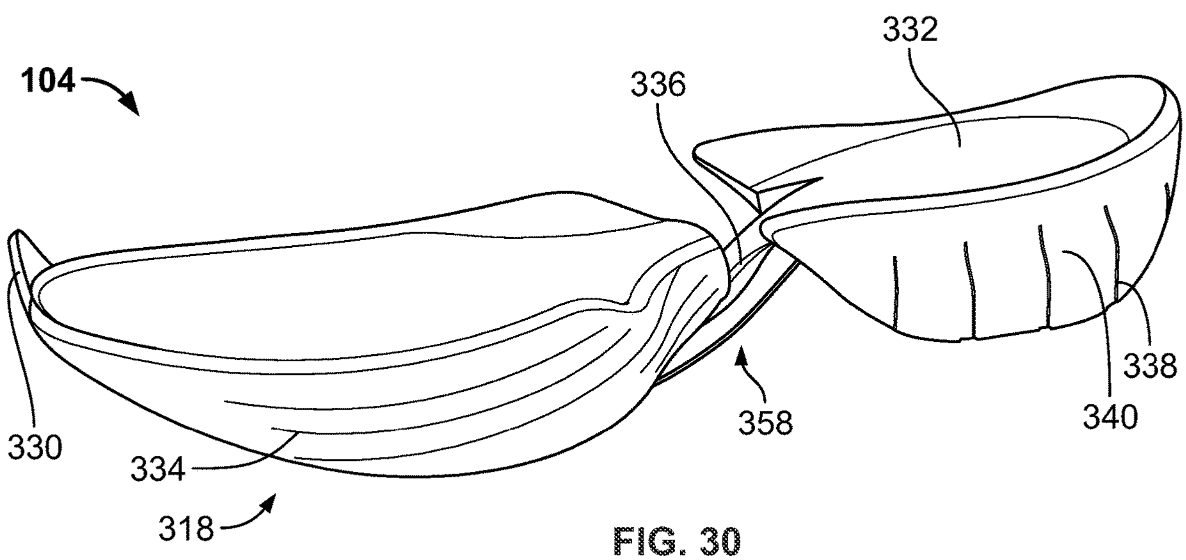
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FIG. 30

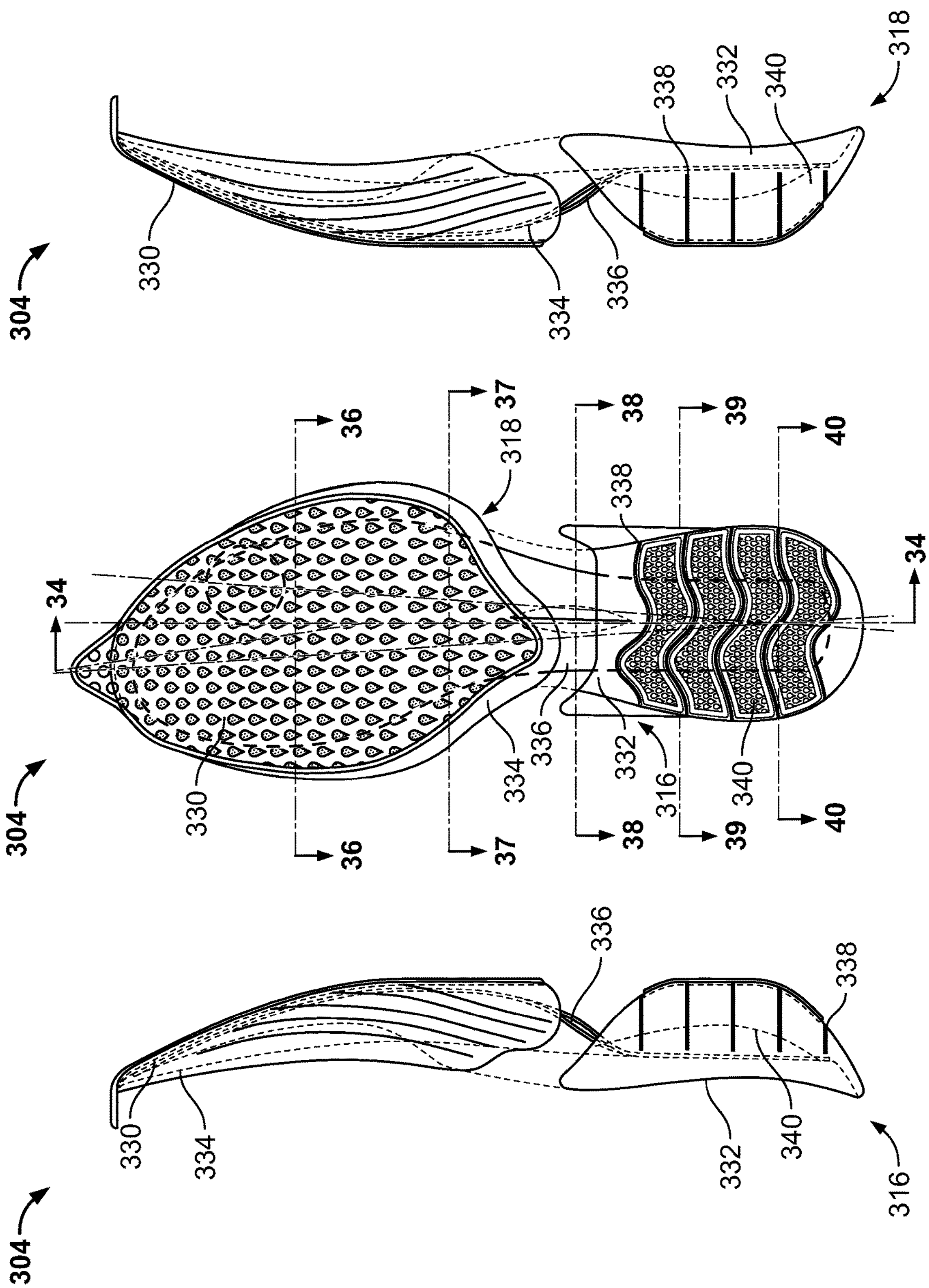


FIG. 31

FIG. 32

FIG. 33

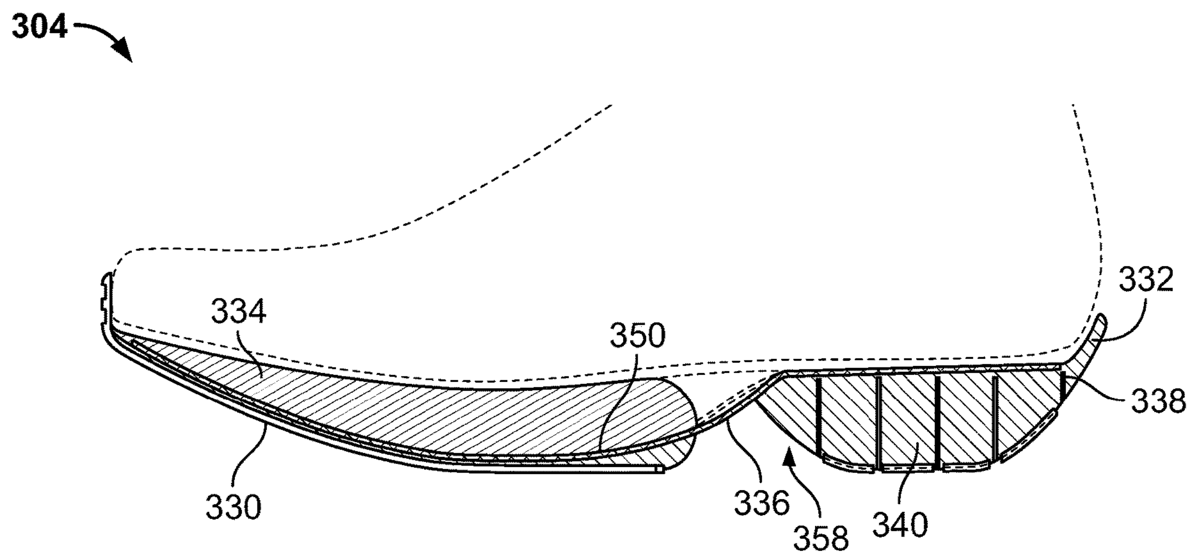


FIG. 34

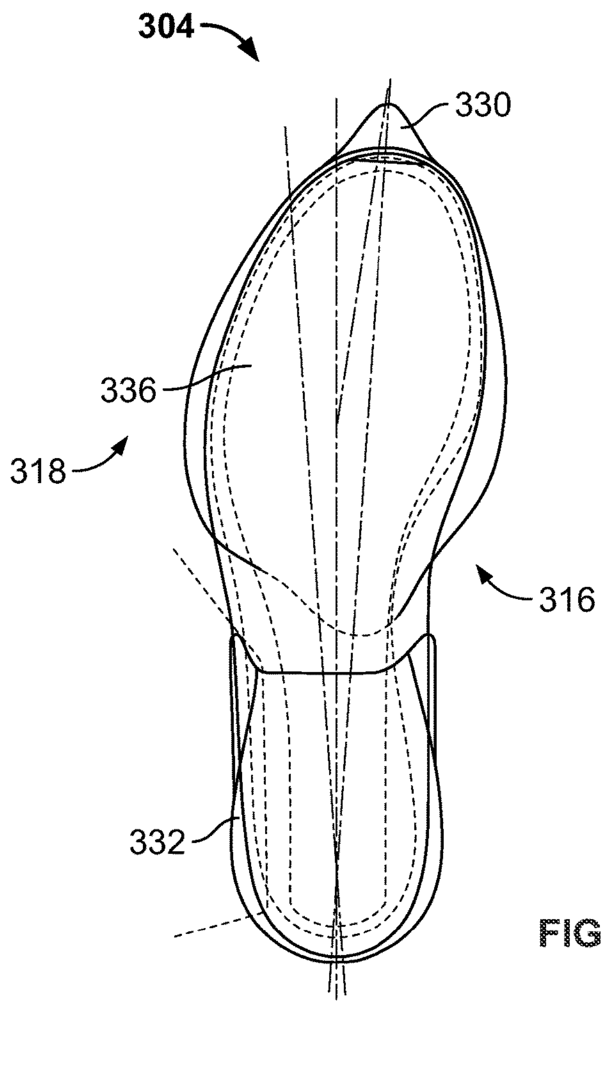


FIG. 35

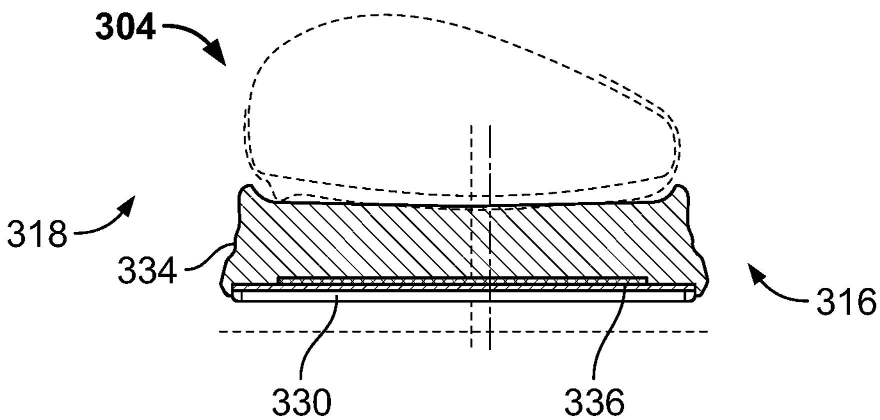


FIG. 36

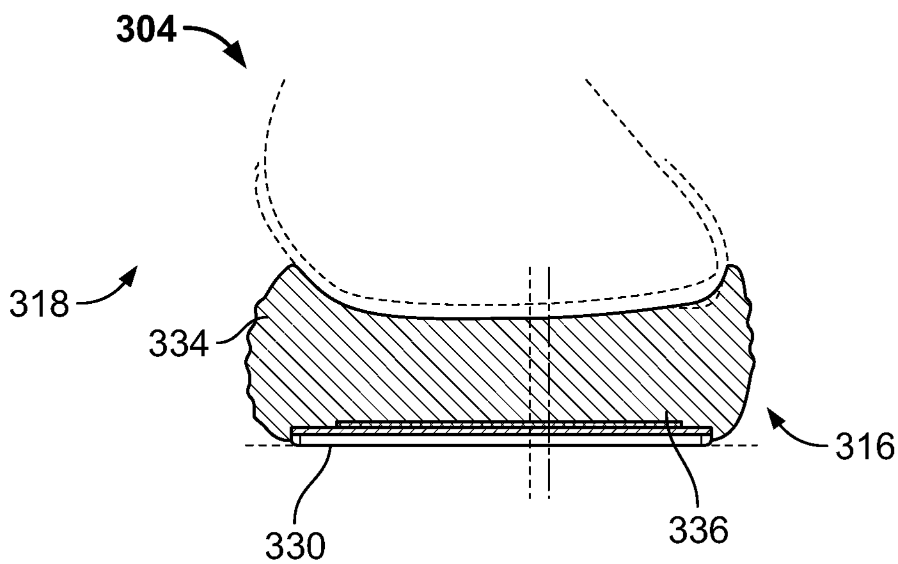


FIG. 37

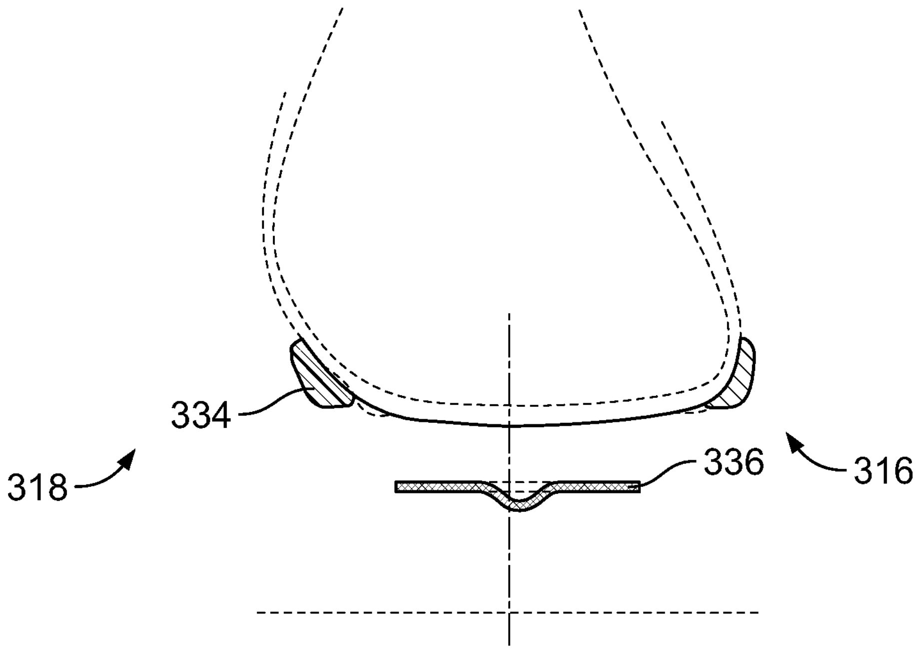


FIG. 38

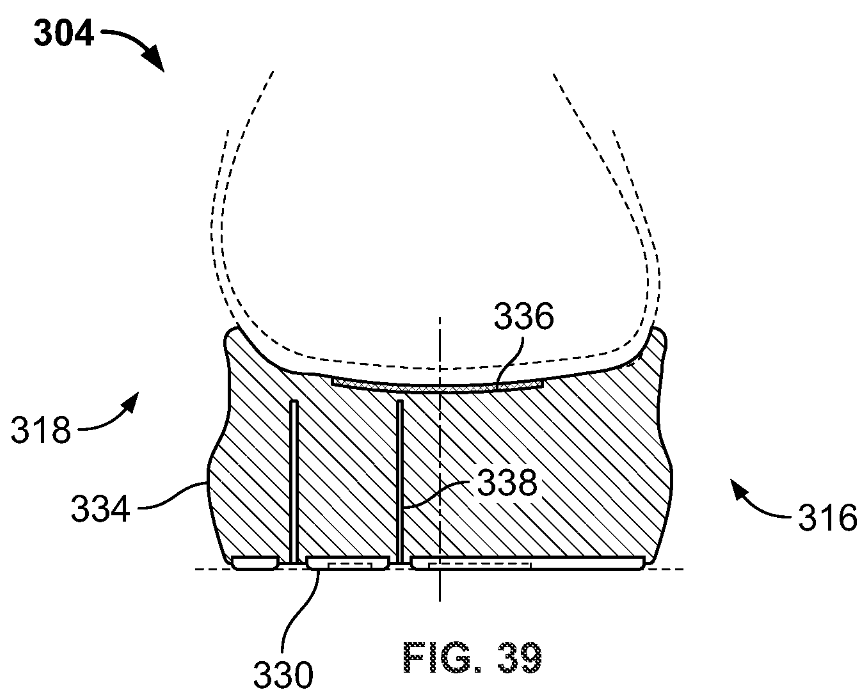


FIG. 39

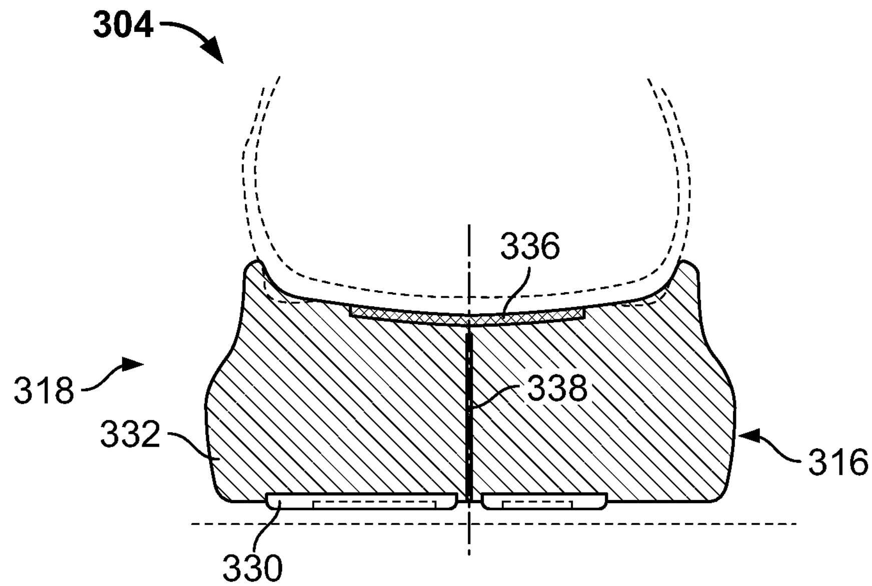


FIG. 40

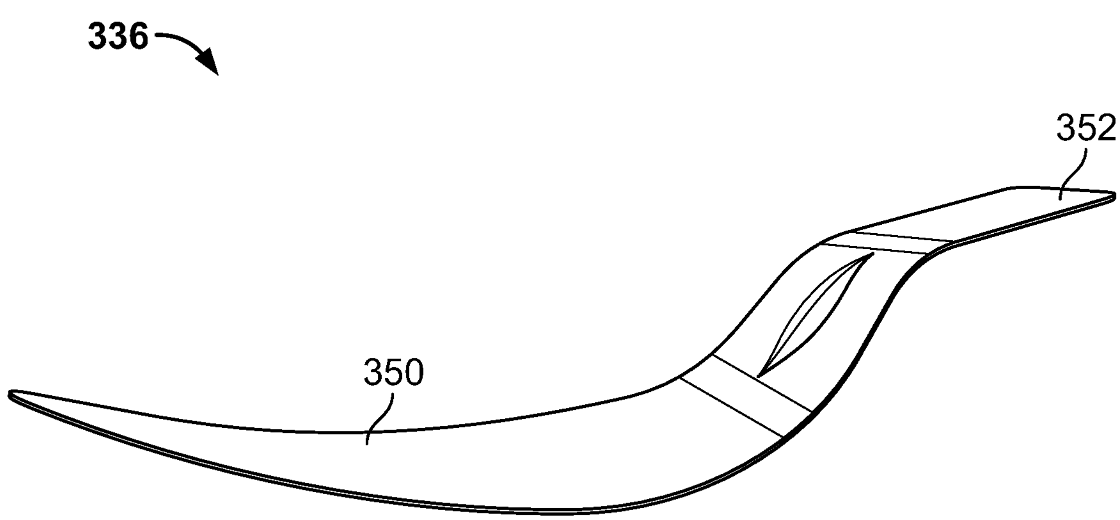


FIG. 41

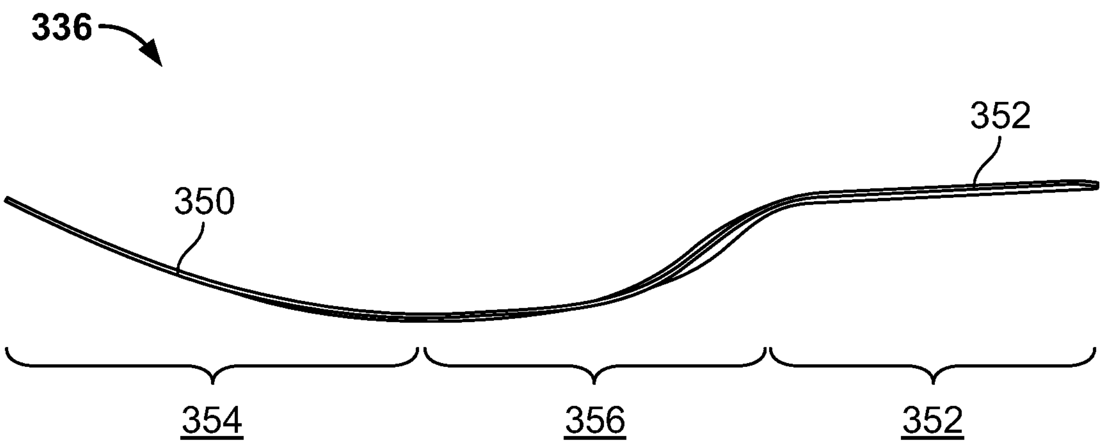


FIG. 42

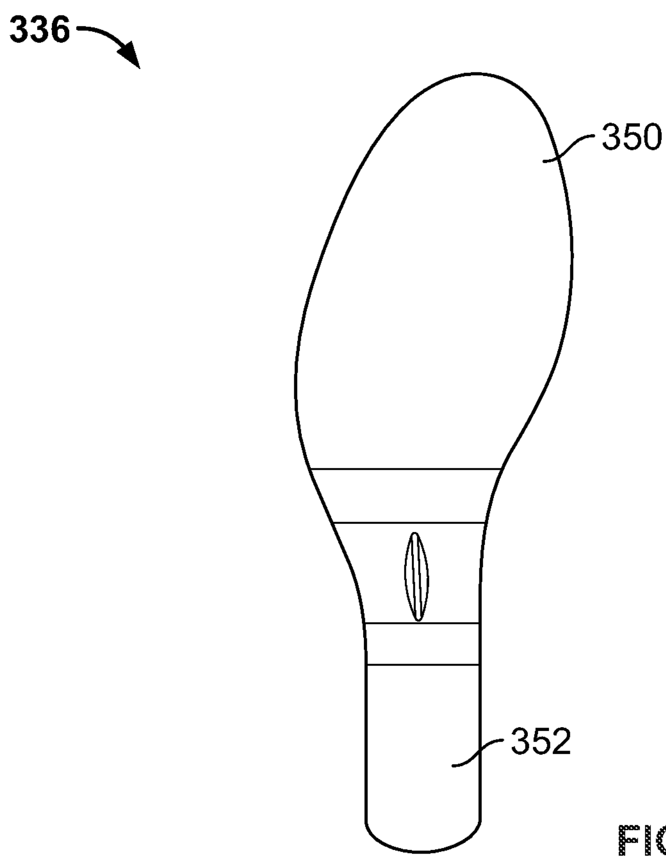


FIG. 43

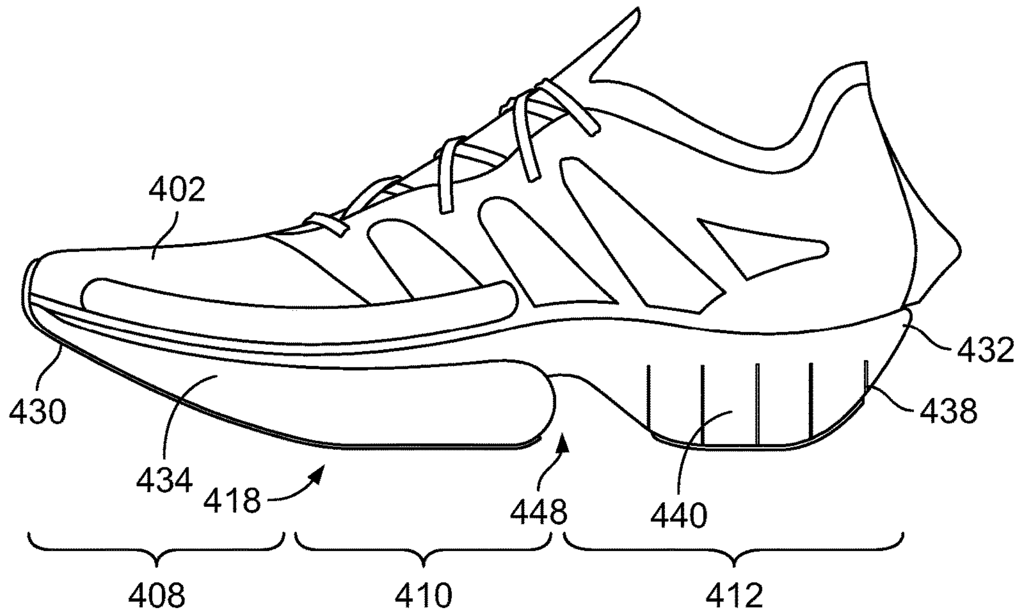

402
432
430
438
434
418
448
440
408
410
412

FIG. 44

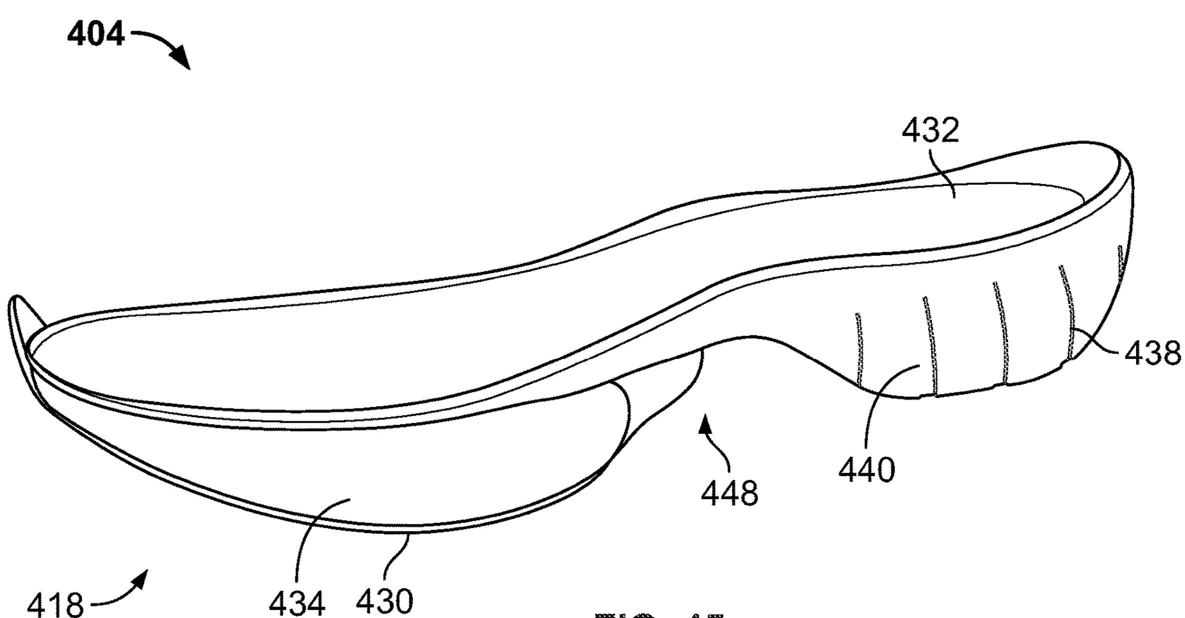

404
432
438
440
448
418
434
430

FIG. 45

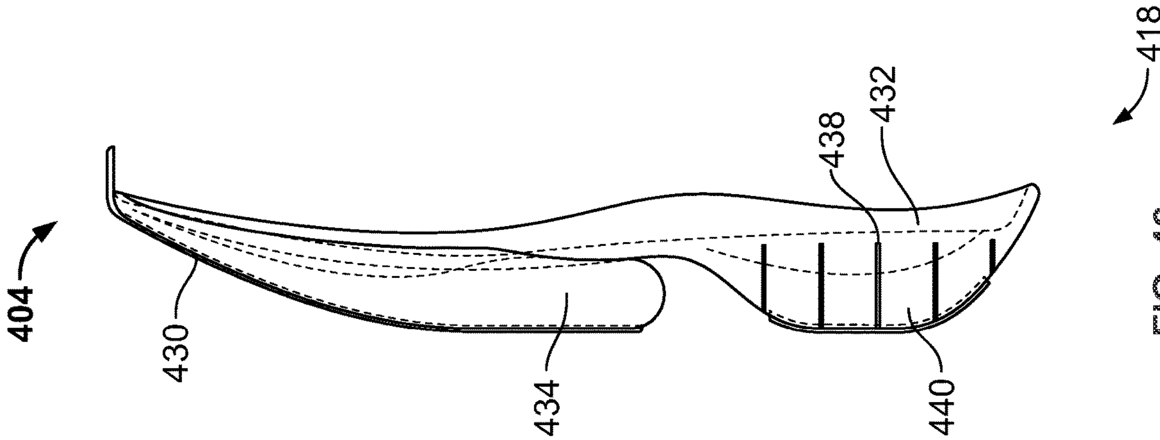


FIG. 46

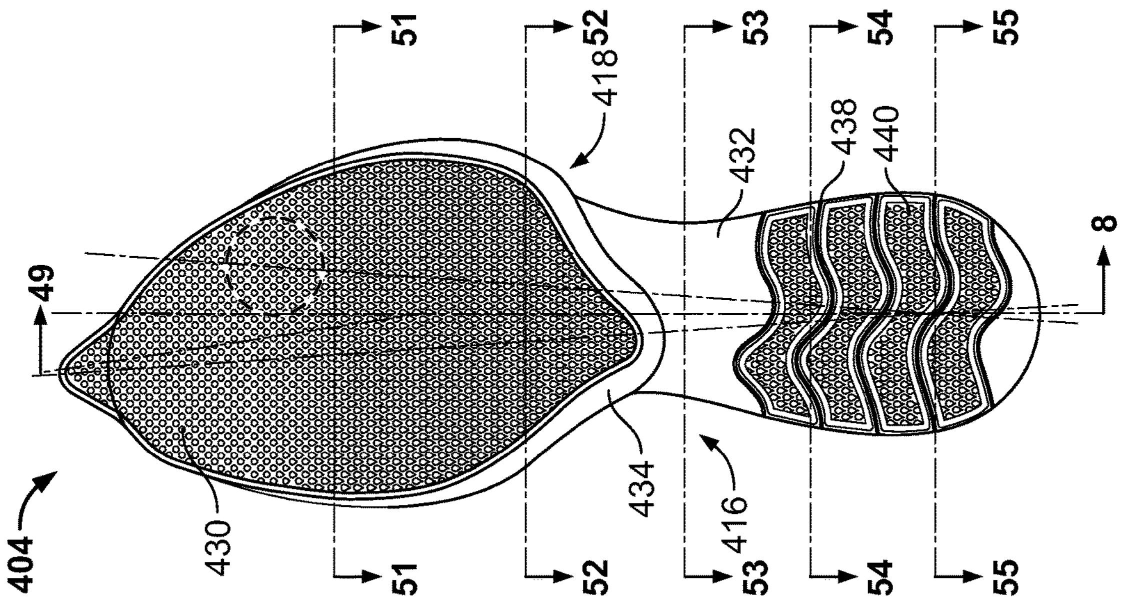


FIG. 47

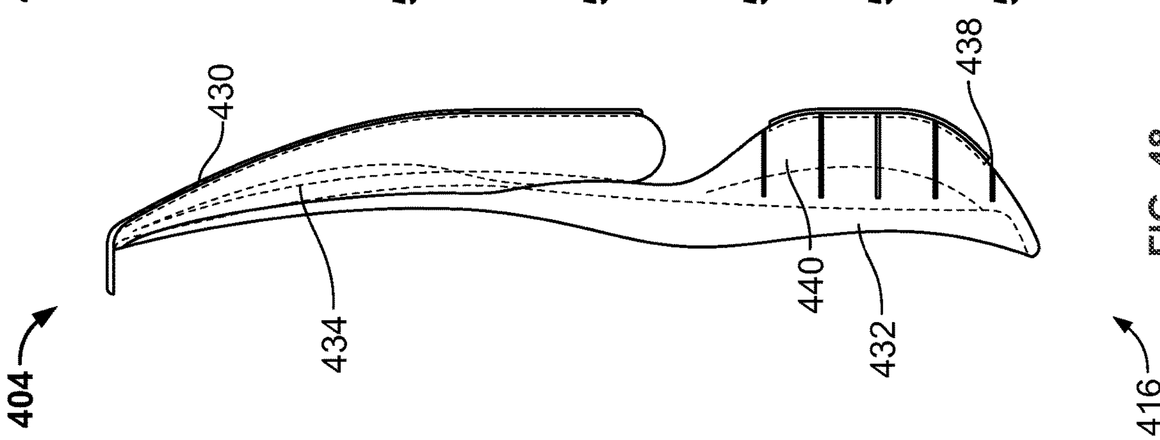


FIG. 48

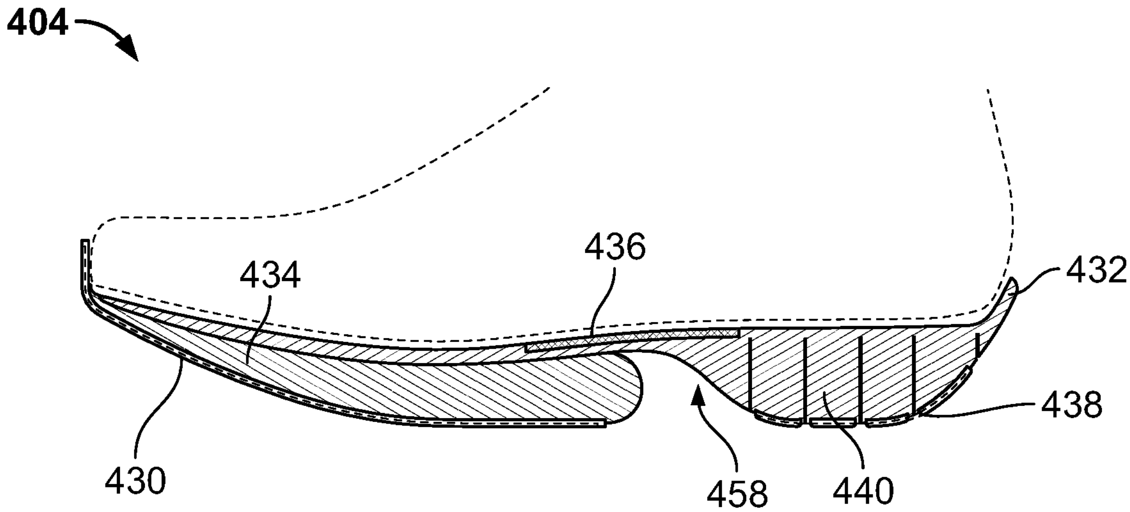


FIG. 49

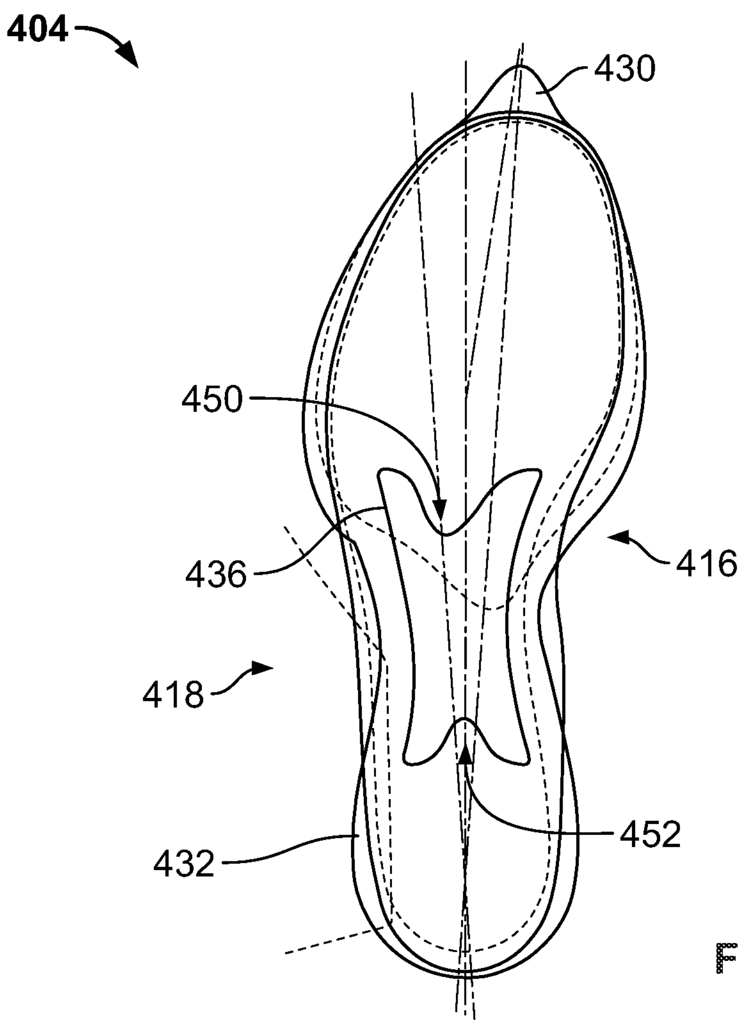


FIG. 50

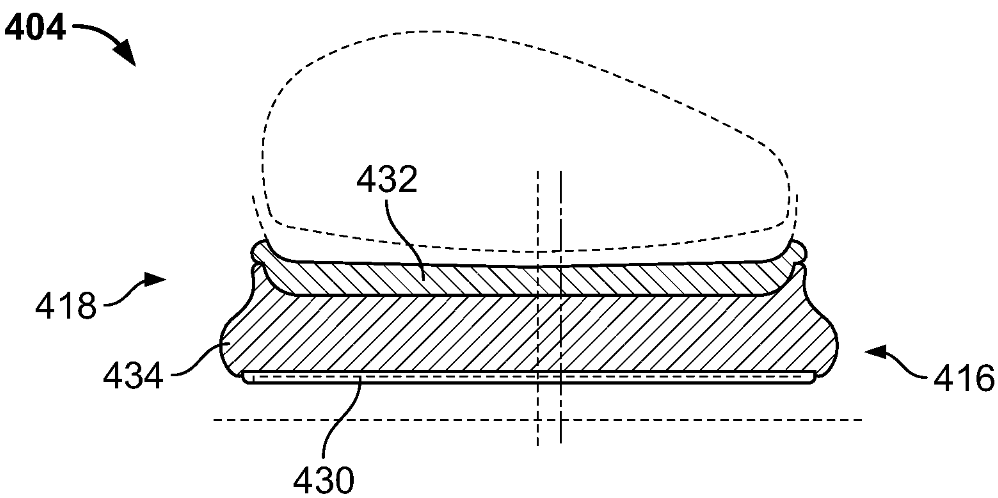


FIG. 51

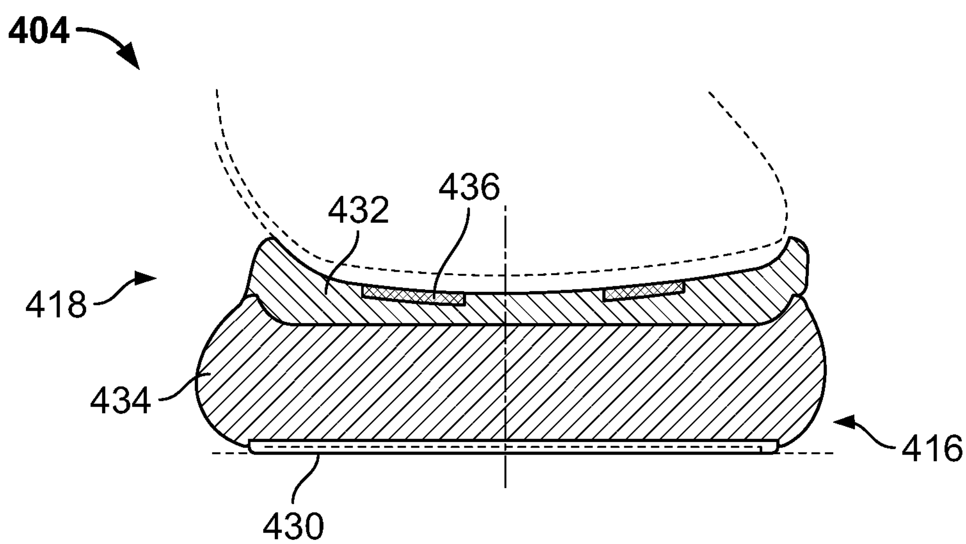


FIG. 52

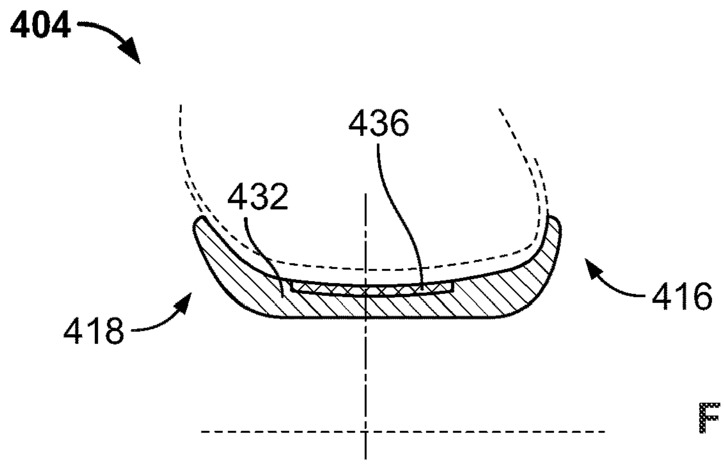


FIG. 53

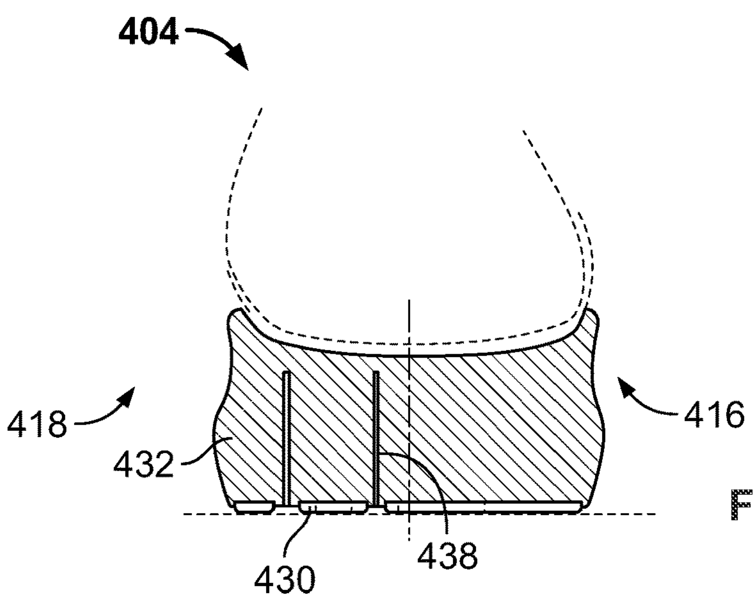


FIG. 54

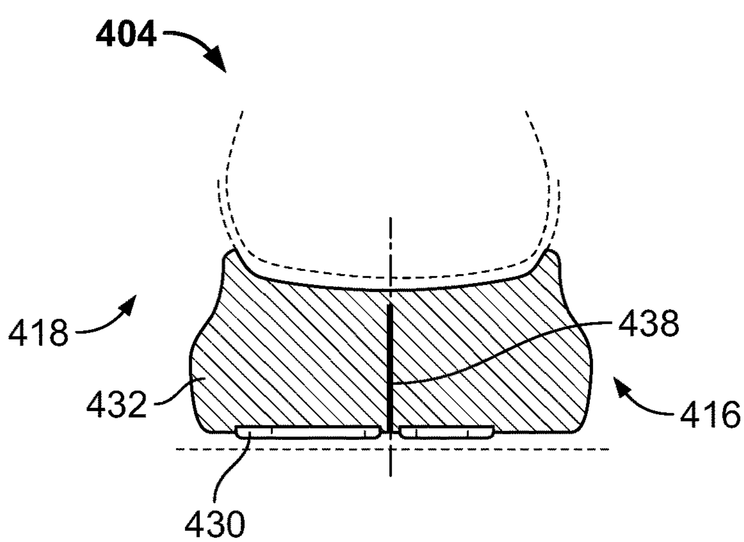


FIG. 55

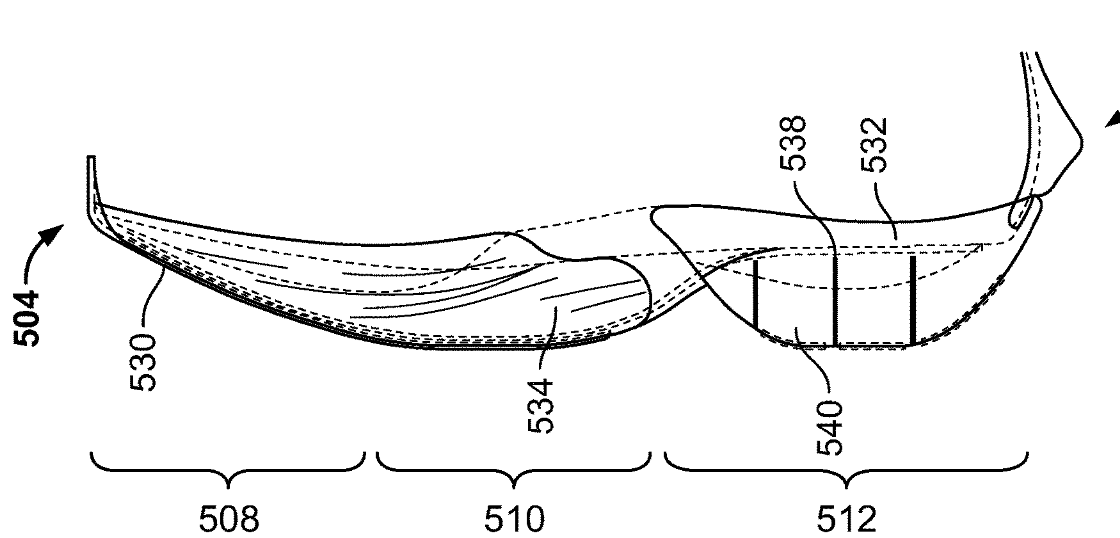


FIG. 56

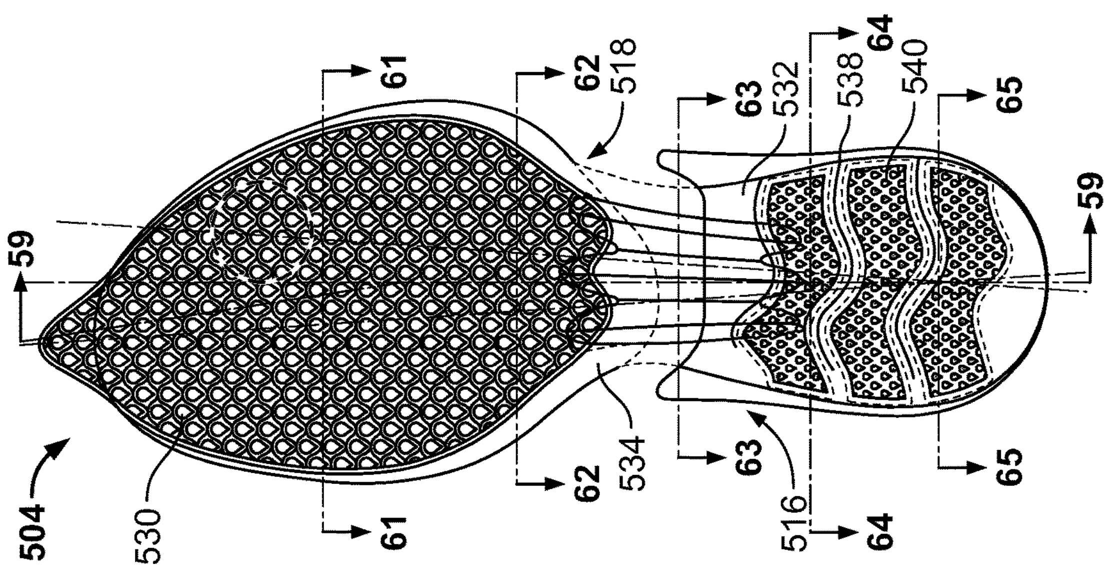


FIG. 57

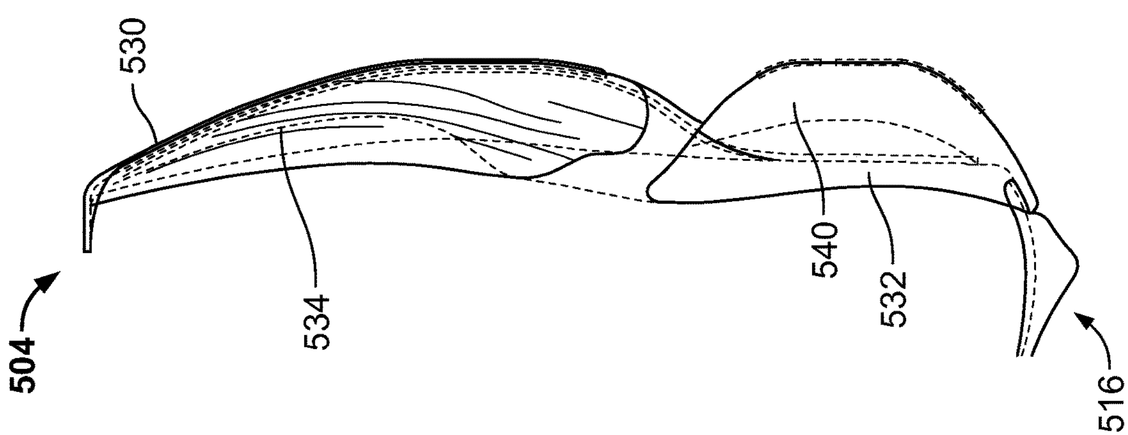


FIG. 58

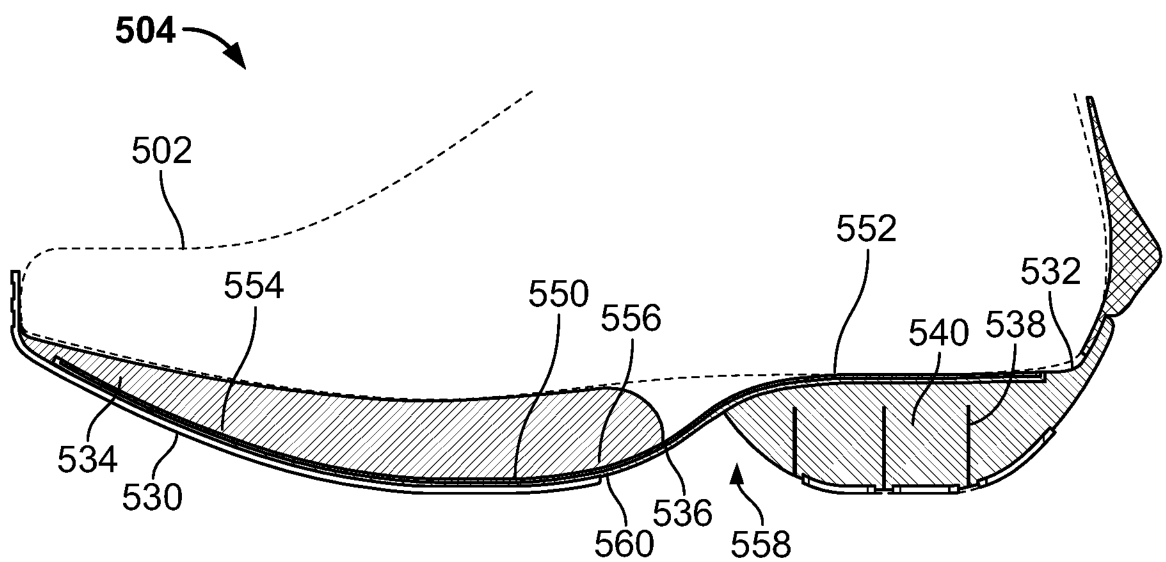

504
502
554
550
556
552
532
540
538
534
530
560
536
558

FIG. 59

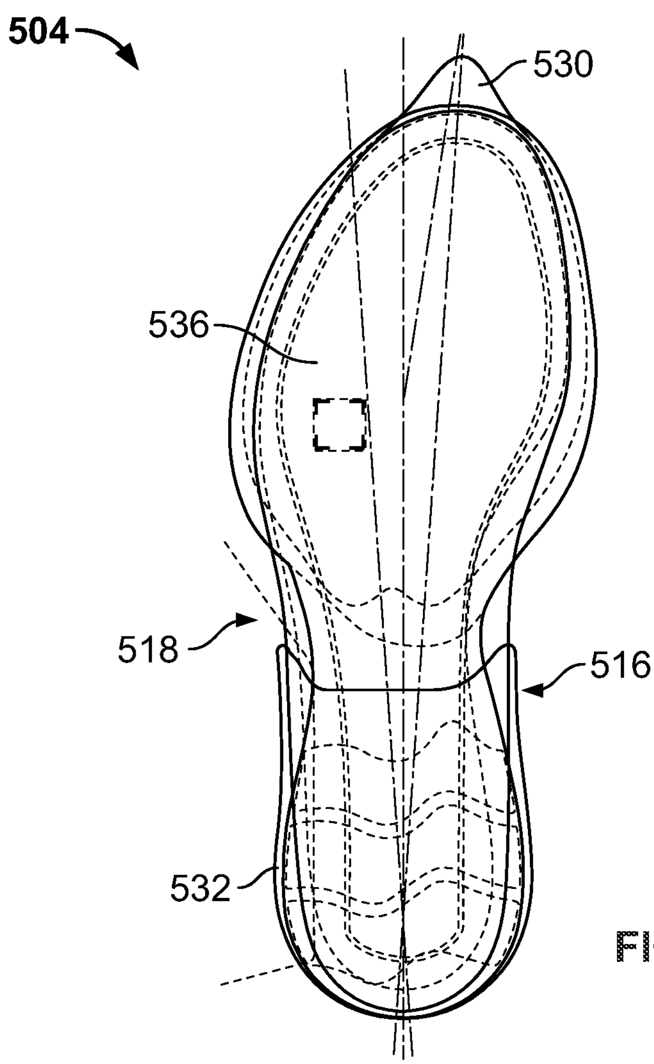

504
530
536
518
516
532

FIG. 60

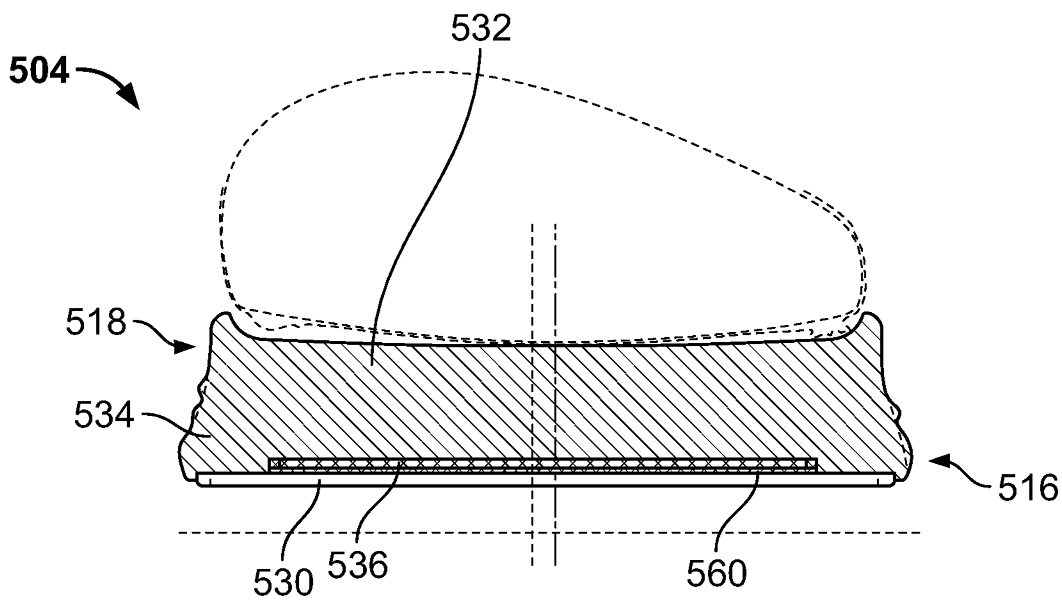


FIG. 61

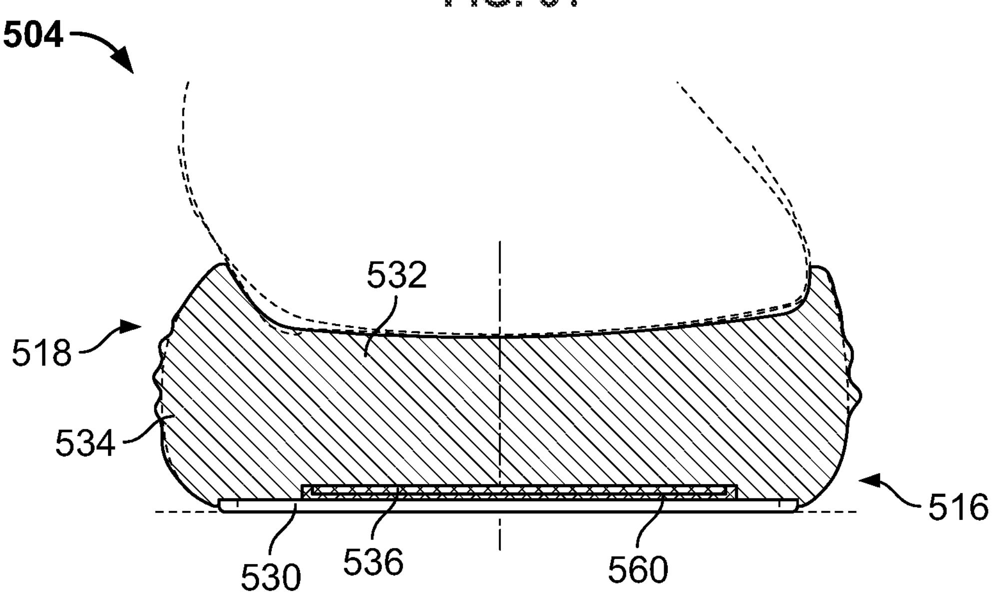


FIG. 62

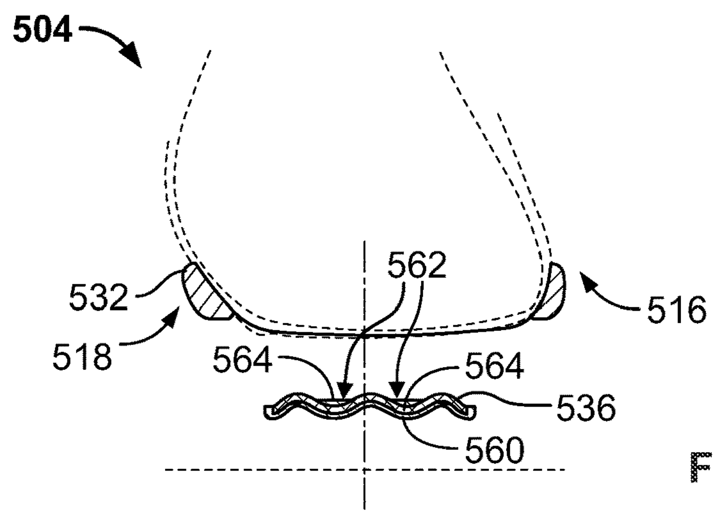


FIG. 63

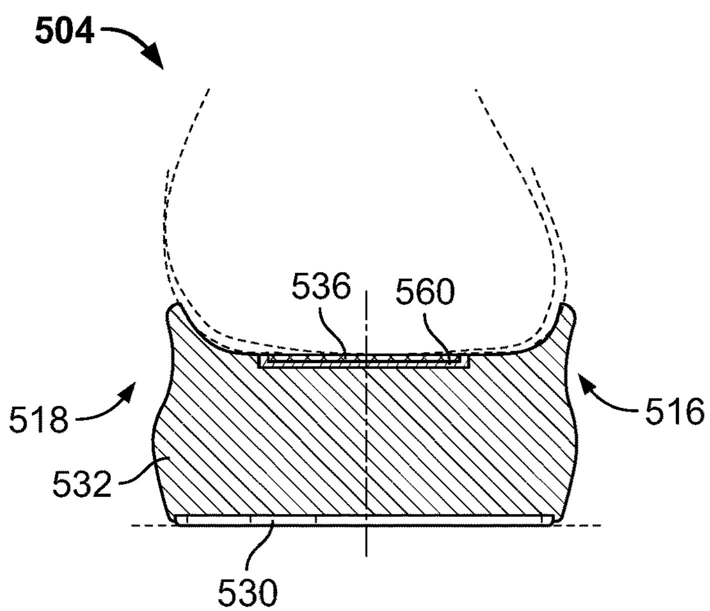


FIG. 64

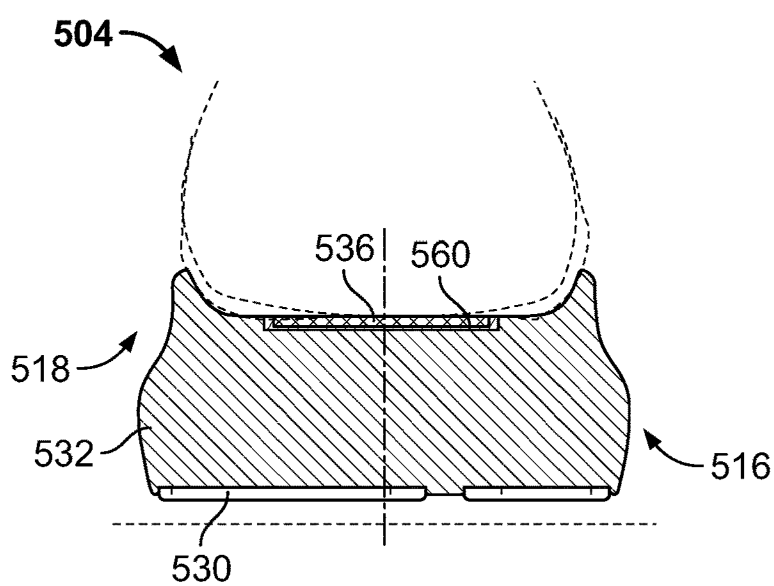


FIG. 65

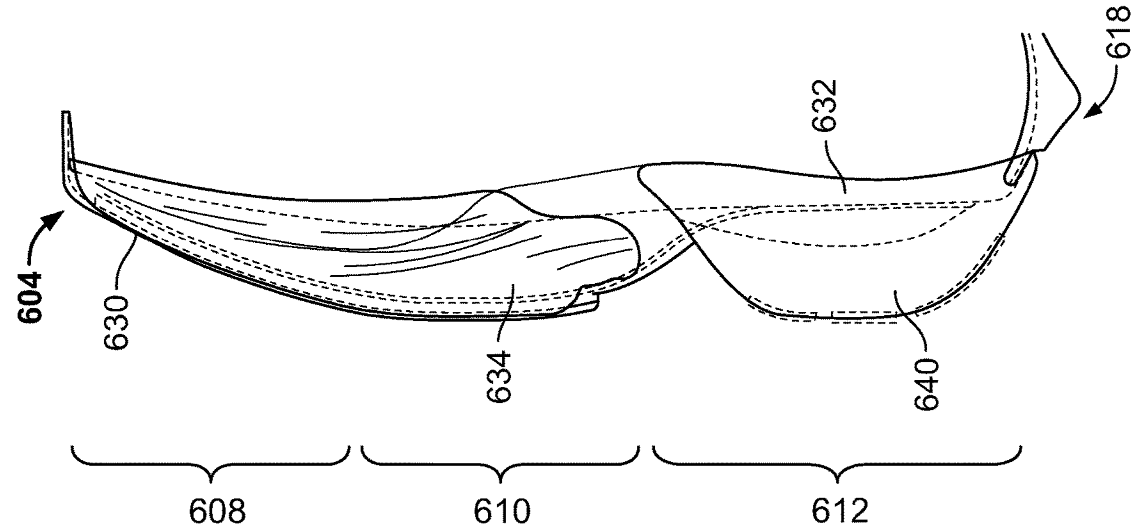


FIG. 66

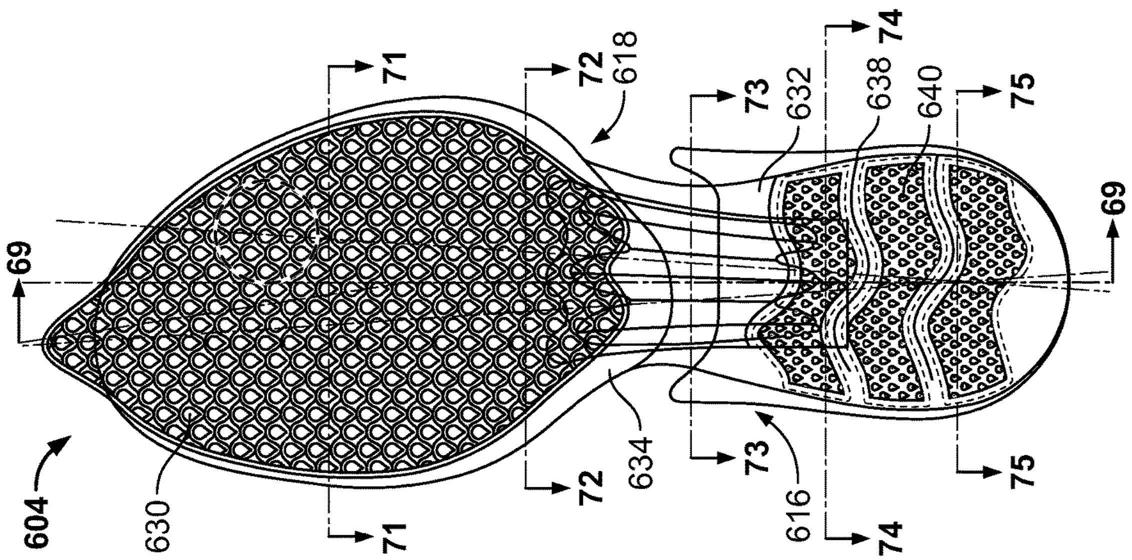


FIG. 67

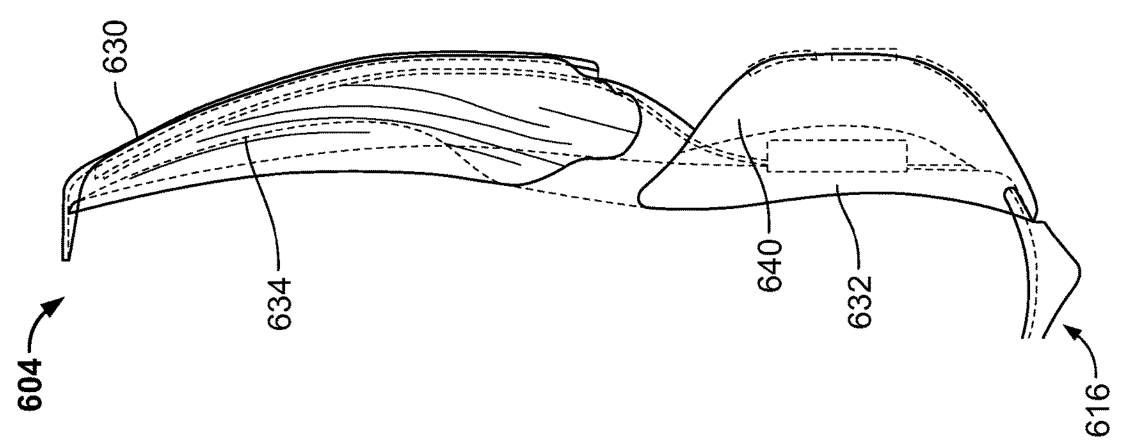


FIG. 68

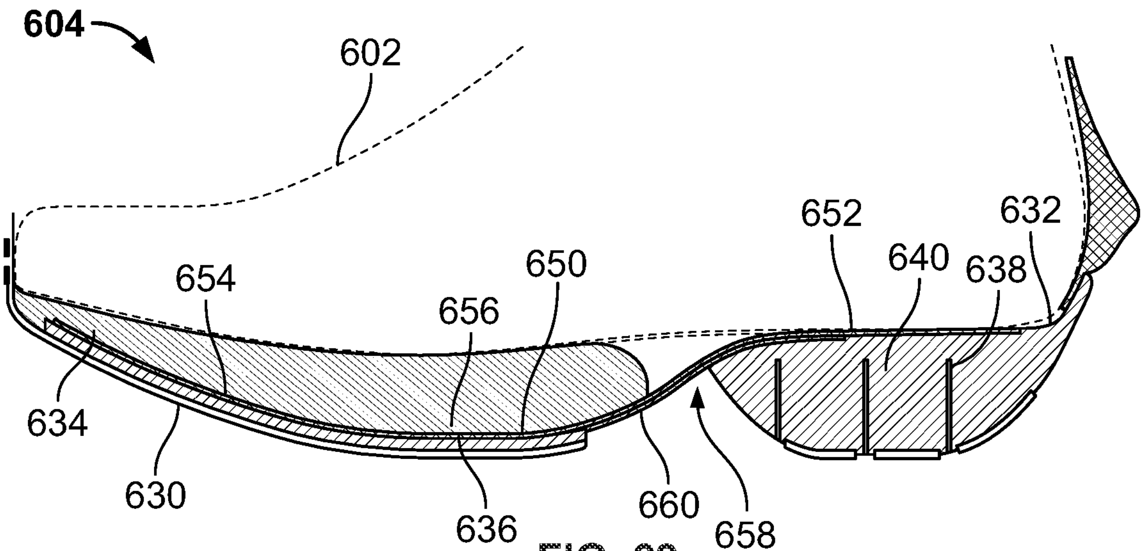

604
602
652
632
640
638
654
650
656
634
630
636
660
658

FIG. 69

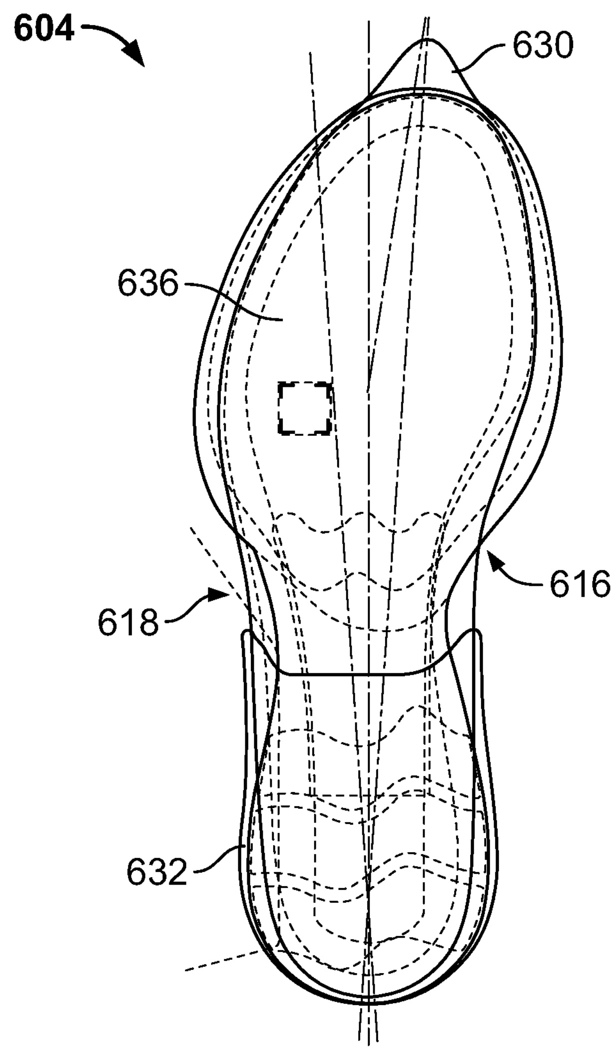

604
630
636
616
618
632

FIG. 70

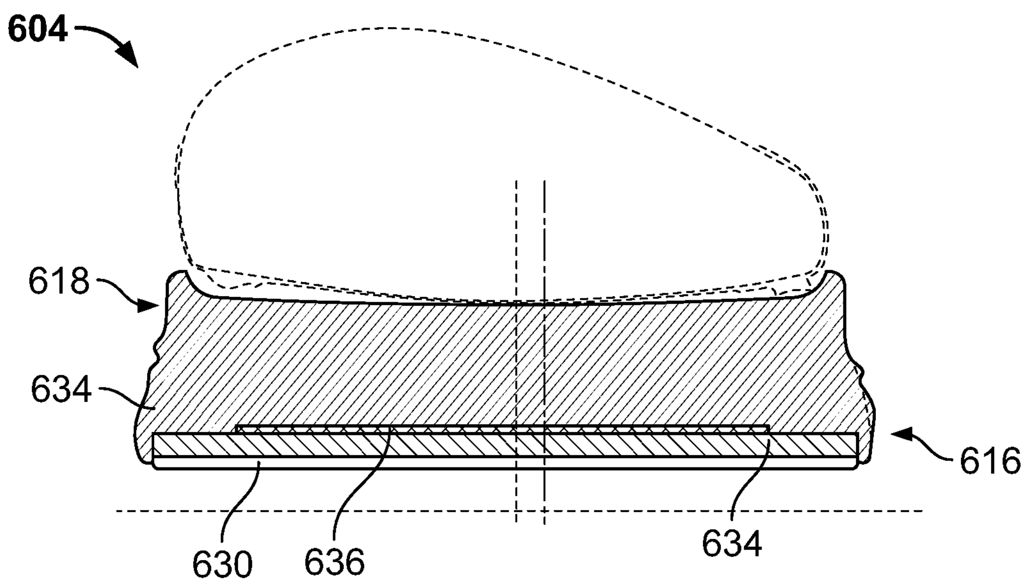


FIG. 71

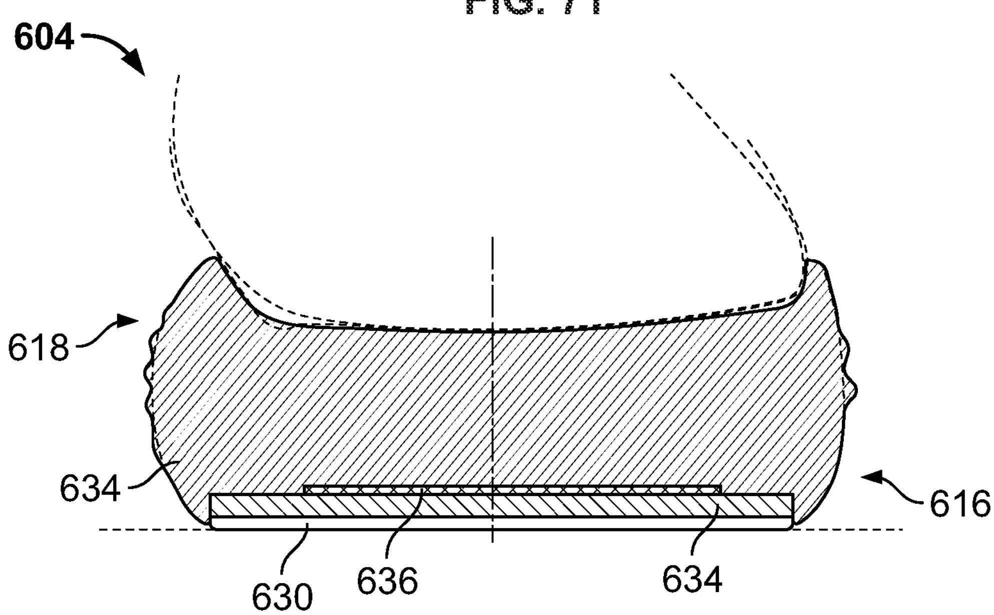


FIG. 72

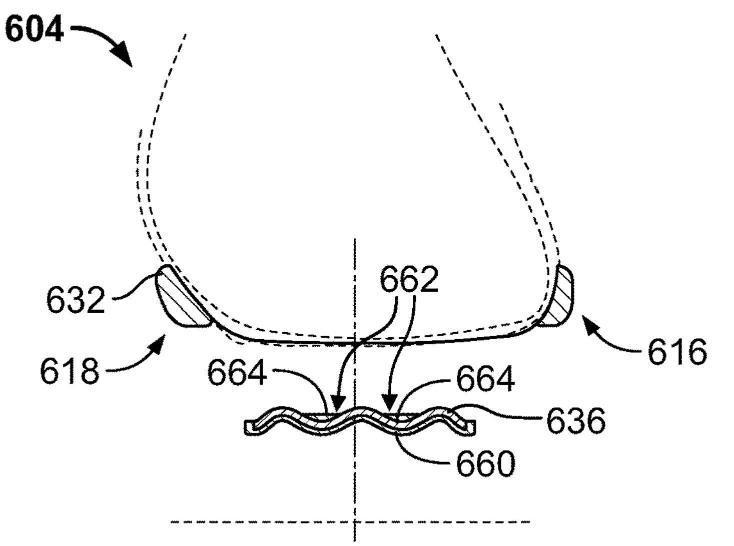


FIG. 73

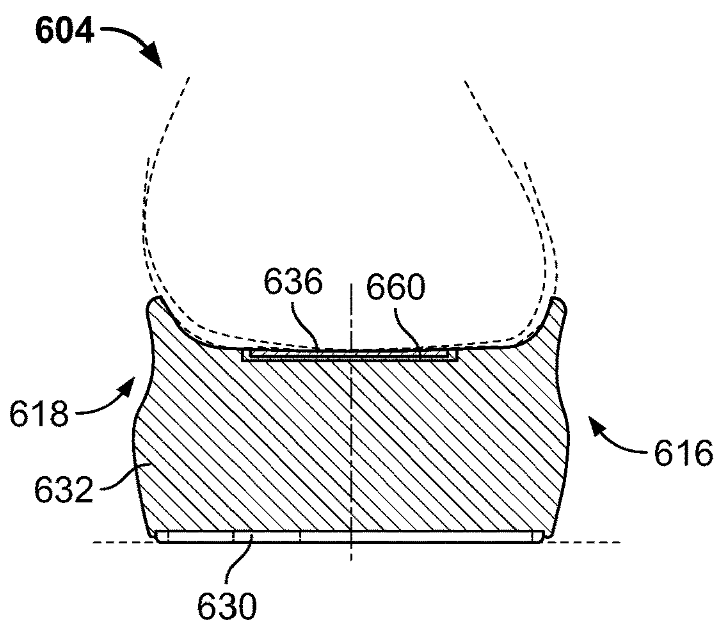


FIG. 74

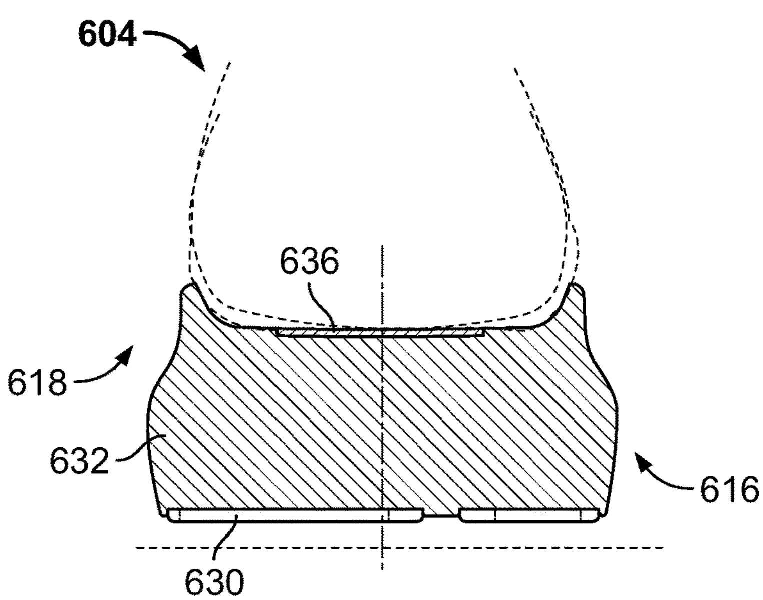


FIG. 75

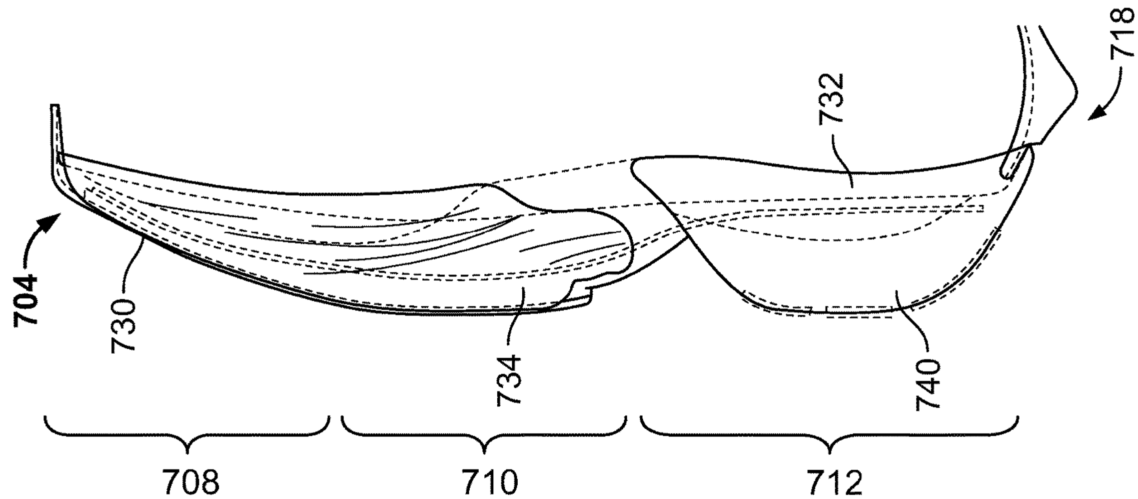


FIG. 76

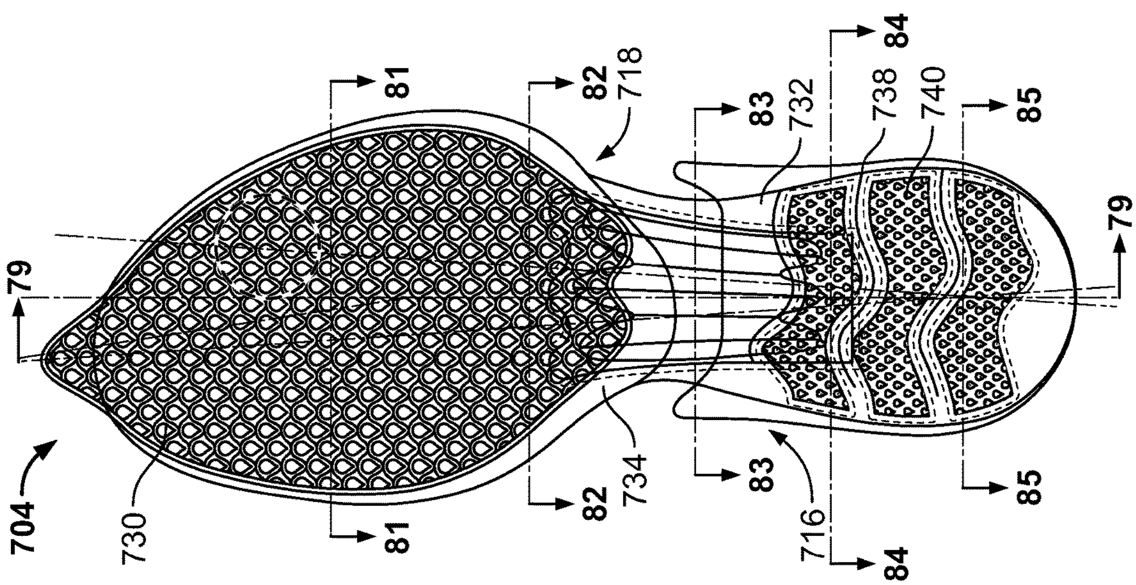


FIG. 77

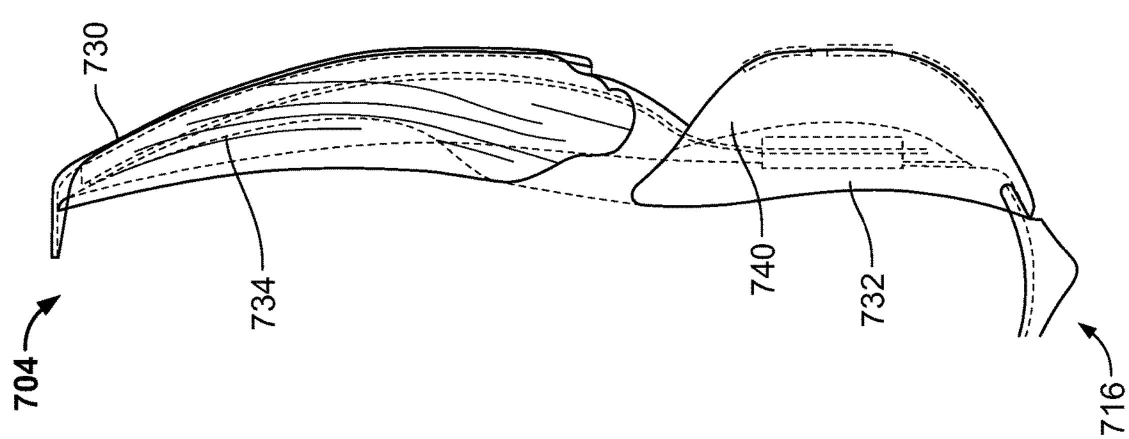


FIG. 78

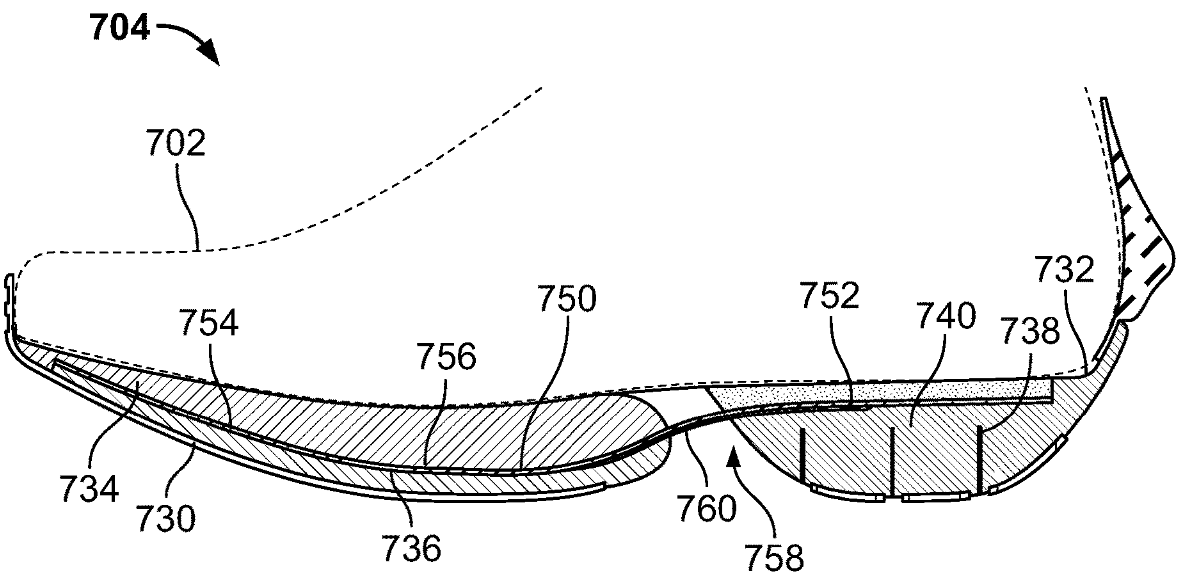

704
702
754
756
750
752
740
732
738
734
730
736
760
758

FIG. 79

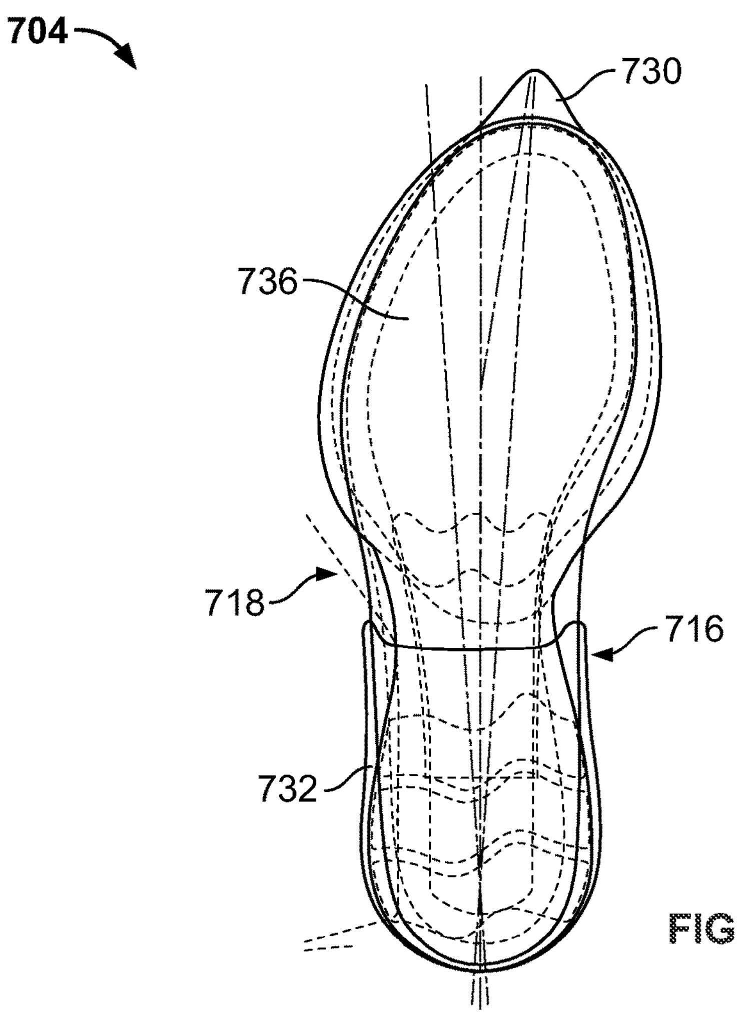

704
730
736
718
716
732

FIG. 80

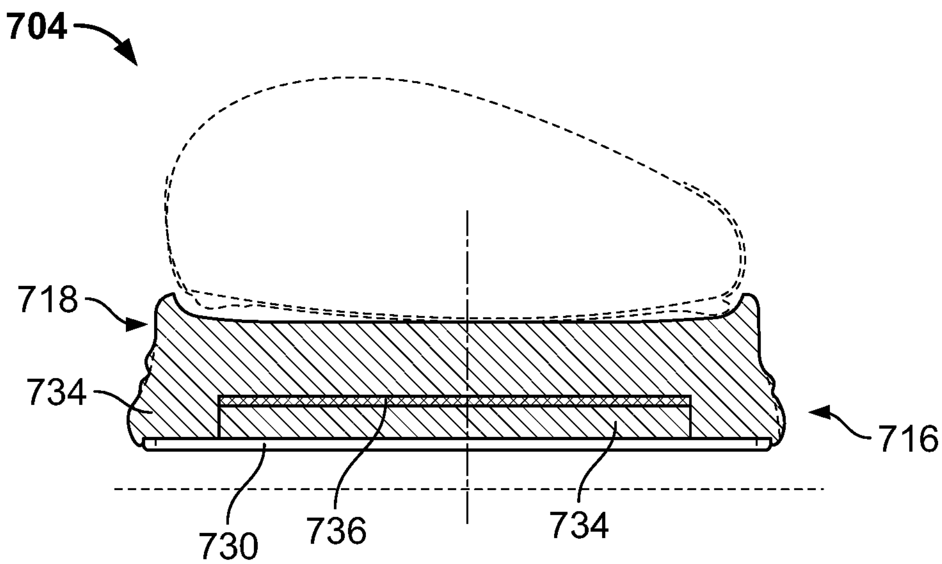


FIG. 81

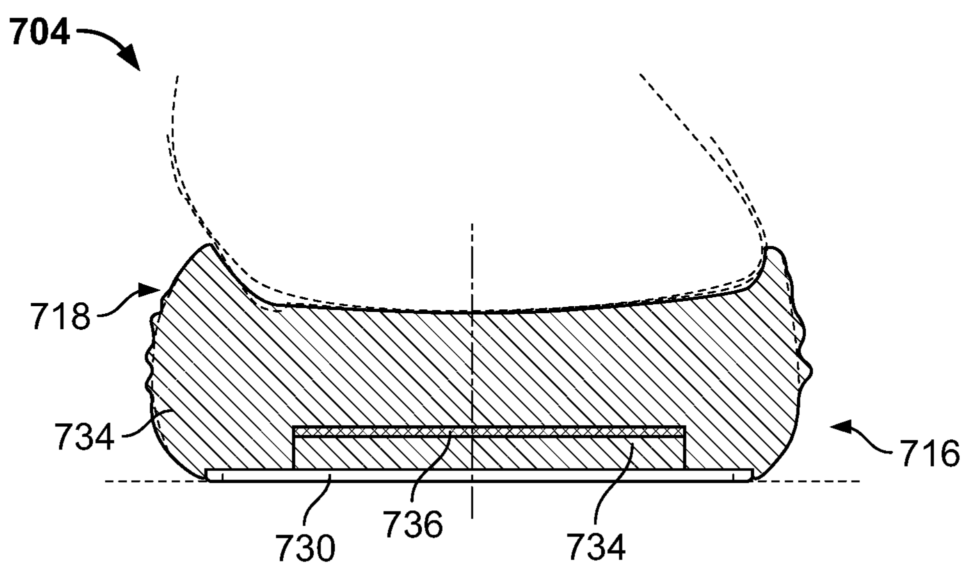


FIG. 82

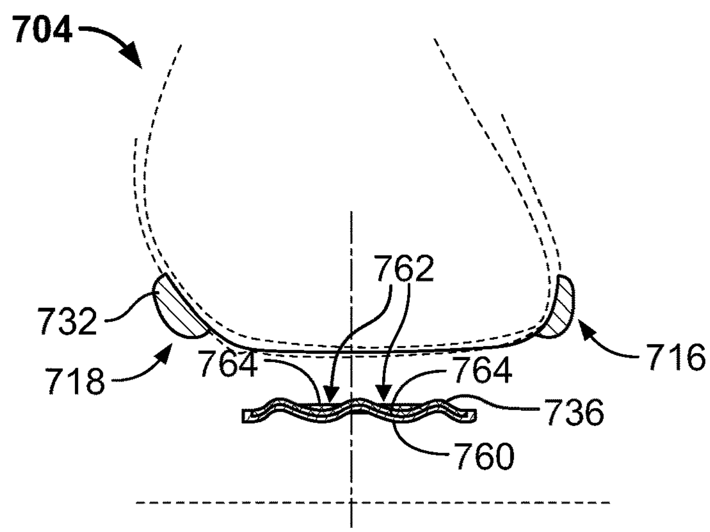


FIG. 83

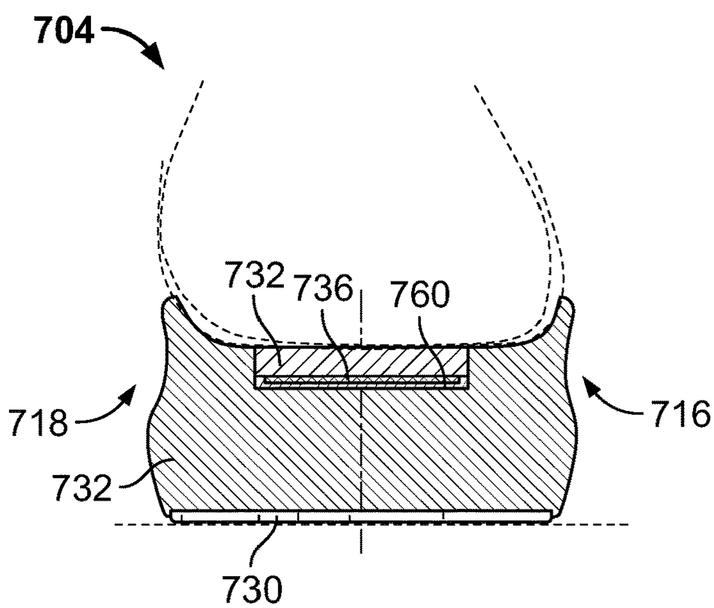


FIG. 84

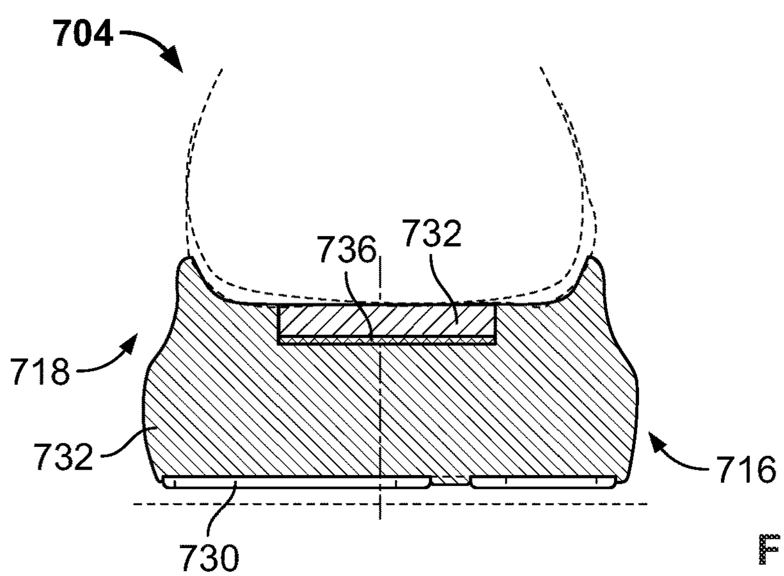


FIG. 85

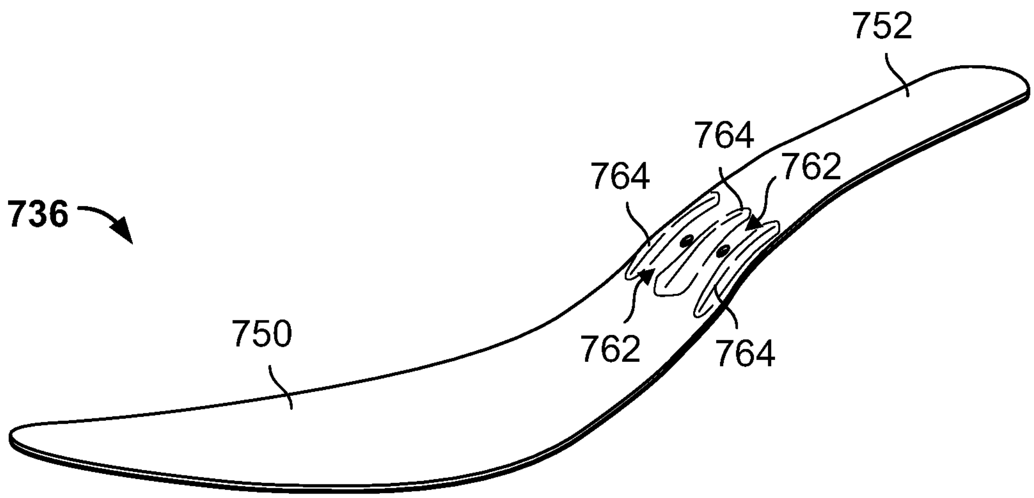


FIG. 86

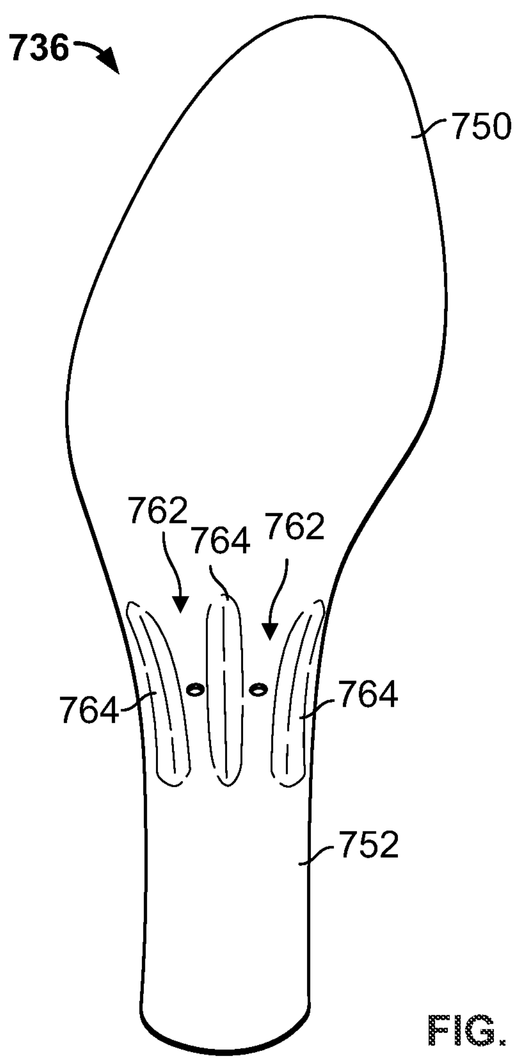


FIG. 87

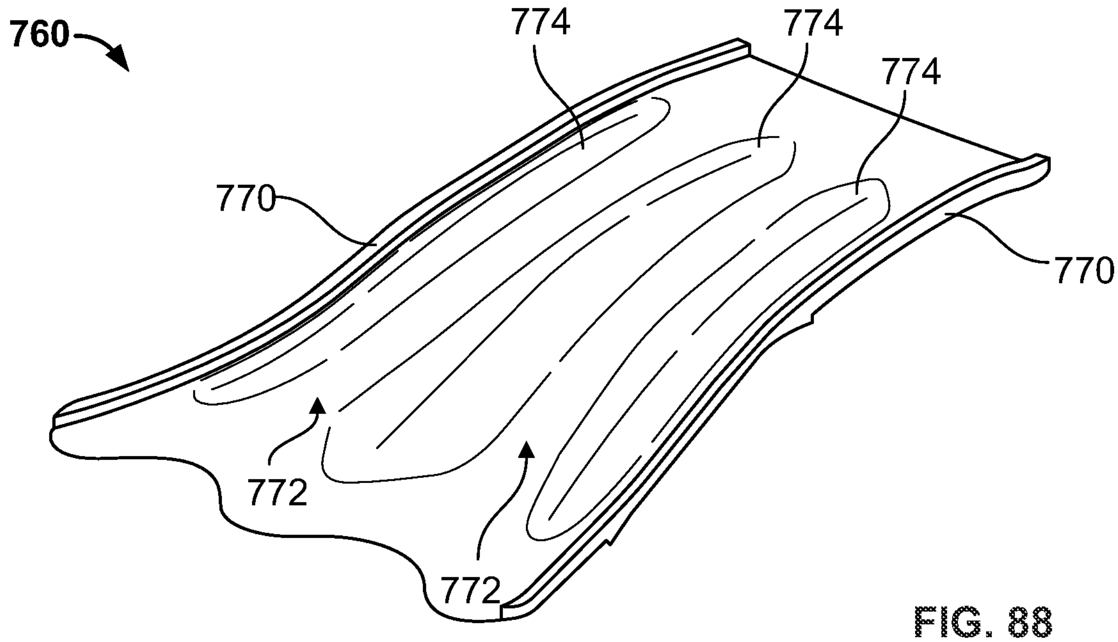


FIG. 88

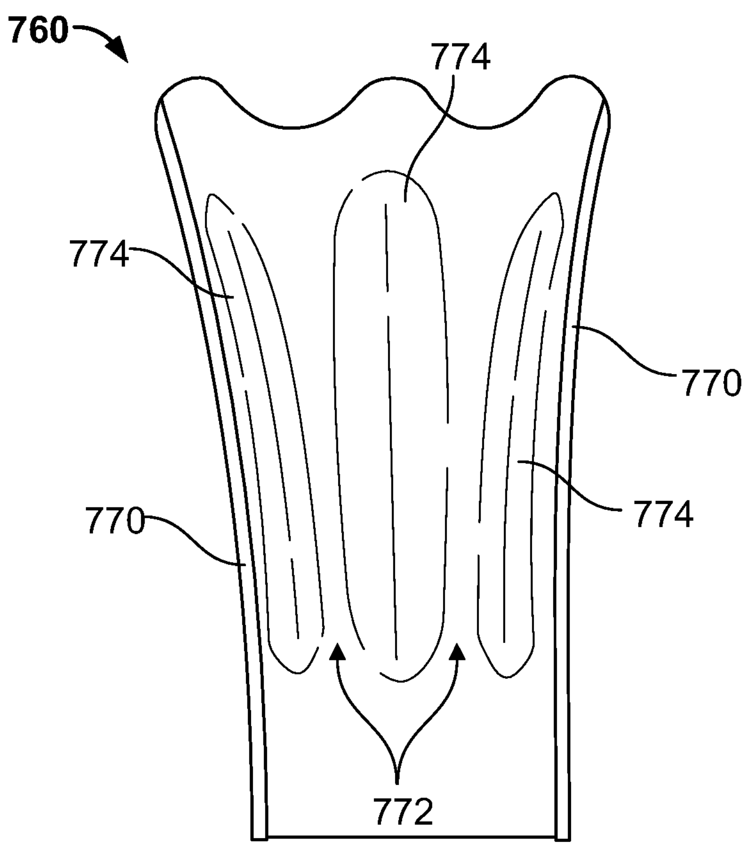


FIG. 89

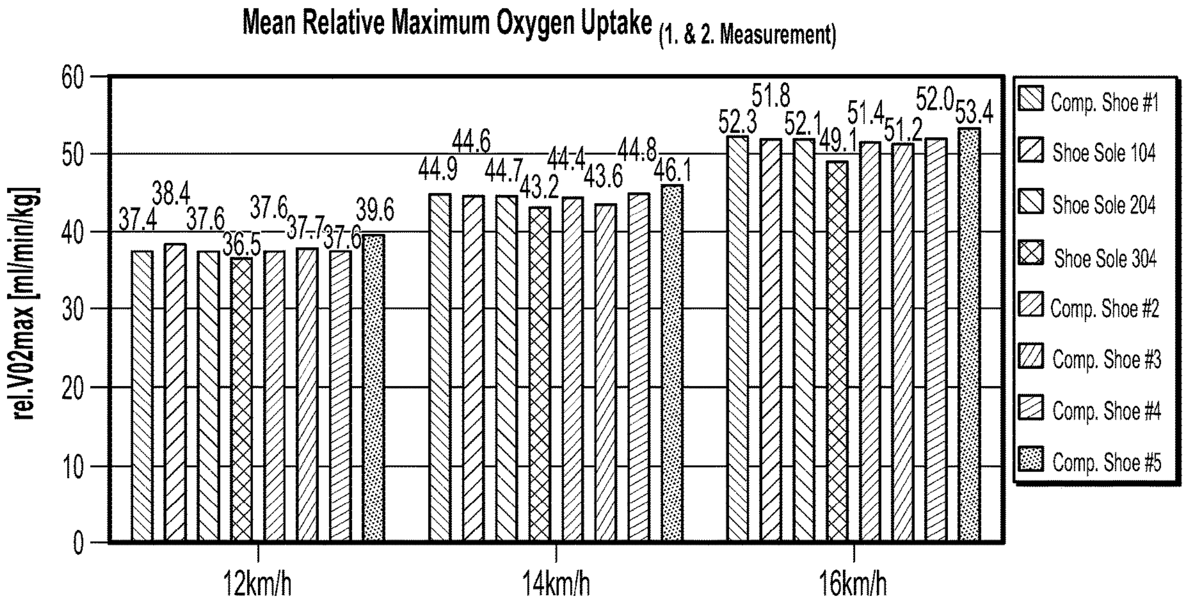

Mean Relative Maximum Oxygen Uptake (1. & 2. Measurement)
rel.V02max [ml/min/kg]
0
10
20
30
40
50
60
37.4
38.4
37.6
36.5
37.6
37.7
37.6
39.6
44.9
44.6
44.7
43.2
44.4
43.6
44.8
46.1
52.3
51.8
52.1
49.1
51.4
51.2
52.0
53.4
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 90

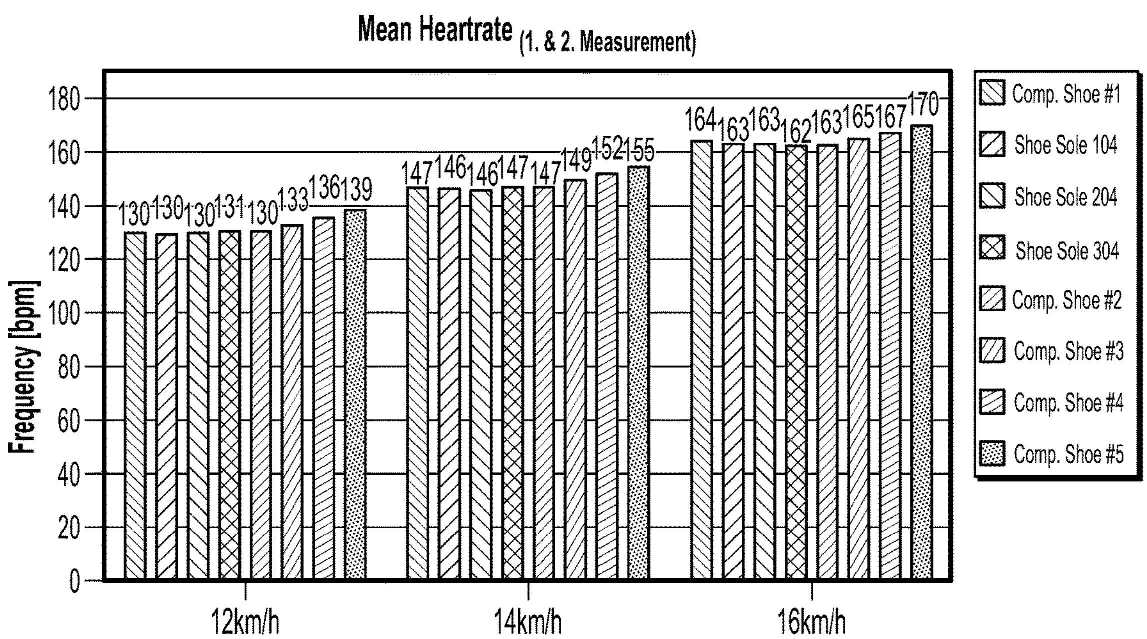

Mean Heartrate (1. & 2. Measurement)
Frequency [bpm]
0
20
40
60
80
100
120
140
160
180
130
130
130
131
130
133
136
139
147
146
146
147
147
149
152
155
164
163
163
162
163
165
167
170
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 91

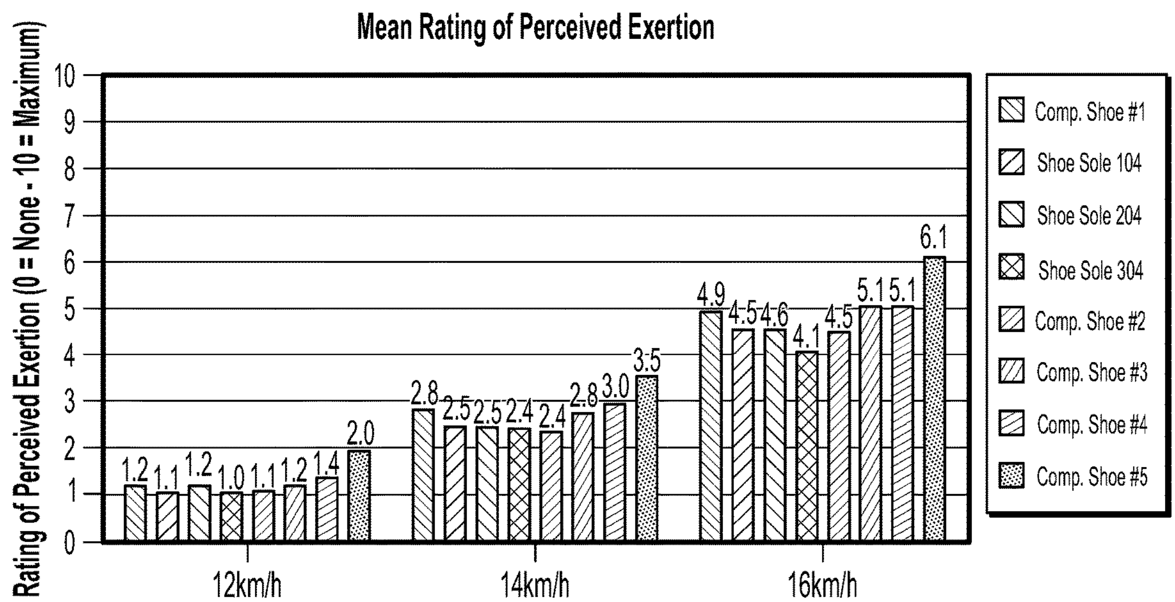

Mean Rating of Perceived Exertion
Rating of Perceived Exertion (0 = None - 10 = Maximum)
0
1
2
3
4
5
6
7
8
9
10
1.2 1.1 1.2 1.0 1.1 1.2 1.4 2.0
2.8 2.5 2.5 2.4 2.4 2.8 3.0 3.5
4.9 4.5 4.6 4.1 4.5 5.1 5.1 6.1
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 92

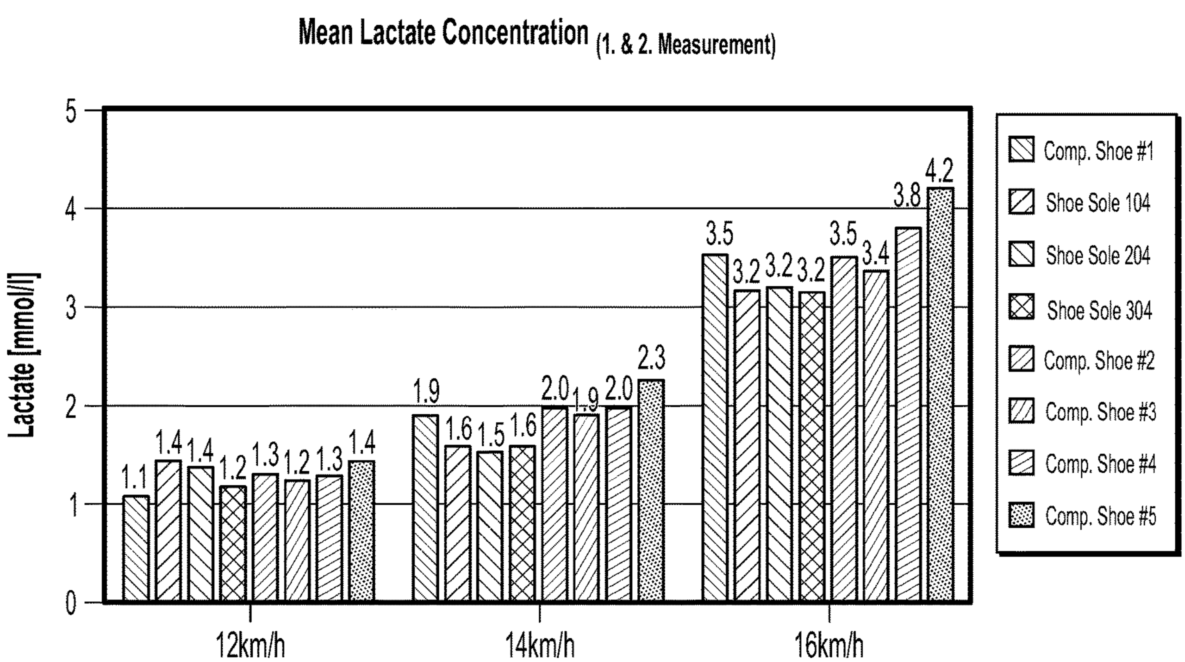

Mean Lactate Concentration (1. & 2. Measurement)
Lactate [mmol/l]
0
1
2
3
4
5
1.1 1.4 1.4 1.2 1.3 1.2 1.3 1.4
1.9 1.6 1.5 1.6 2.0 1.9 2.0 2.3
3.5 3.2 3.2 3.2 3.5 3.4 3.8 4.2
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 93

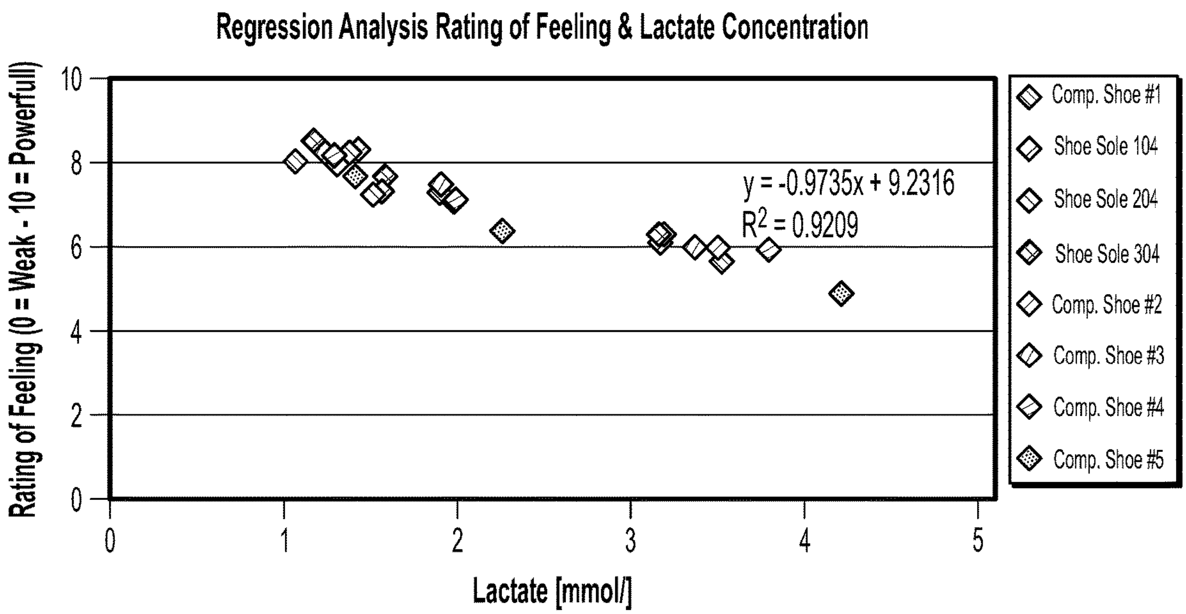

Regression Analysis Rating of Feeling & Lactate Concentration
Rating of Feeling (0 = Weak - 10 = Powerfull)
10
8
6
4
2
0
0
1
2
3
4
5
Lactate [mmol/]
y = -0.9735x + 9.2316
R2 = 0.9209
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 94

ARTICLE OF FOOTWEAR HAVING A SOLE PLATE

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 17/404,388, filed Aug. 17, 2021, which claims the benefit of U.S. Provisional Patent Application 63/067,073, filed on Aug. 18, 2020, the entire contents of which is hereby incorporated by reference, for any and all purposes.

REFERENCE REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

SEQUENCE LISTING

Not applicable

BACKGROUND

1. Field of the Invention

The present disclosure relates generally to an article of footwear including a sole plate.

2. Description of the Background

Many conventional shoes or other articles of footwear generally comprise an upper and a sole attached to a lower end of the upper. Conventional shoes further include an internal space, i.e., a void or cavity, which is created by interior surfaces of the upper and sole, that receives a foot of a user before securing the shoe to the foot. The sole attaches to a lower surface or boundary of the upper and positions itself between the upper and the ground. As a result, the sole typically provides stability and cushioning to the user when the shoe is being worn. In some instances, the sole may include multiple components, such as an outsole, a midsole, and an insole. The outsole may provide traction to a bottom surface of the sole, and the midsole may be attached to an inner surface of the outsole, and may provide cushioning or added stability to the sole. For example, a sole may include a particular foam material that may increase stability at one or more desired locations along the sole, or a foam material that may reduce stress or impact energy on the foot or leg when a user is running, walking, or engaged in another activity. The sole may also include additional components, such as plates, embedded with the sole to increase the overall stiffness of the sole and reduce energy loss during use.

The upper generally extends upward from the sole and defines an interior cavity that completely or partially encases a foot. In most cases, the upper extends over the instep and toe regions of the foot, and across medial and lateral sides thereof. Many articles of footwear may also include a tongue that extends across the instep region to bridge a gap between edges of medial and lateral sides of the upper, which define an opening into the cavity. The tongue may also be disposed below a lacing system and between medial and lateral sides of the upper, to allow for adjustment of shoe tightness. The tongue may further be manipulable by a user to permit entry or exit of a foot from the internal space or cavity. In addition, the lacing system may allow a user to adjust certain dimensions of the upper or the sole, thereby allowing the upper to accommodate a wide variety of foot types having varying sizes and shapes.

The upper of many shoes may comprise a wide variety of materials, which may be utilized to form the upper and chosen for use based on one or more intended uses of the shoe. The upper may also include portions comprising varying materials specific to a particular area of the upper. For example, added stability may be desirable at a front of the upper or adjacent a heel region so as to provide a higher degree of resistance or rigidity. In contrast, other portions of a shoe may include a soft woven textile to provide an area with stretch-resistance, flexibility, air-permeability, or moisture-wicking properties.

However, in many cases, articles of footwear having uppers with an increased comfort and better fit are desired, along with soles having improved cushioning systems or structural characteristics such as a sole plate to add rigidity or spring-like properties.

SUMMARY

An article of footwear, as described herein, may have various configurations. The article of footwear may have an upper and a sole structure connected to the upper.

According to one aspect of the disclosure, a sole structure for an article of footwear having an upper can include a first cushioning member disposed in a heel region of the sole structure and a second cushioning member disposed in a forefoot region of the sole structure. The second cushioning member can be and spaced apart from the first cushioning member by a gap that can extend between the first cushioning member and the second cushioning member. A sole plate can extend across the gap between the first cushioning member and the second cushioning member.

In some embodiments, the sole plate can include a rear portion and a curved portion. The curved portion can include an anterior curved portion disposed proximate the second cushioning member and a posterior portion that can span the gap between the first cushioning member and the second cushioning member. The rear portion can be disposed within the heel region and can include a planar portion. In some cases, the curved portion can be coupled to the second cushioning member and the rear portion can be coupled to at least one of the first cushioning member and the upper. The second cushioning member can be positioned between the sole plate and the upper.

In some embodiments, the first cushioning member can include a longitudinal groove within the heel region. The longitudinal groove can segment the first cushioning member into a first flex zone and a second flex zone. In some cases, the sole structure can further include an outsole. The outsole can include a first outsole portion secured to the first flex zone and a second outsole portion secured to the second flex zone.

In some embodiments, the sole structure can include an outsole defining a ground engaging surface, which can be discontinuous in a midfoot region. In some cases, the first cushioning member can be positioned between the sole plate and the outsole in the heel region, and/or the second cushioning member can be positioned between the sole plate and the outsole in the forefoot region. The sole plate can be positioned between the first cushioning member and the upper, and/or the second cushioning member can be positioned between the sole plate and the upper.

In some embodiments, the first cushioning member can extend from the heel region into a midfoot region and the

second cushioning member can extend from the forefoot region into the midfoot region. A front end of the first cushioning member can extend from the heel region toward and past a rear end of the second cushioning member in the midfoot region such that the front end of the first cushioning member can be closer to the forefoot region than can be the rear end of the second cushioning member. The front end of the first cushioning member can be positioned above the rear end of the second cushioning member.

In some embodiments, the at least one of the first cushioning member and the second cushioning member can be a supercritical foam with pockets of gas therein. The sole plate can extend through the gap between the first cushioning member and the second cushioning member.

According to another aspect of the disclosure, a sole structure for an article of footwear having an upper can include a first cushioning member and a second cushioning member. The second cushioning member can be spaced apart from the first cushioning member by a gap that can extend between the first cushioning member and the second cushioning member. A sole plate can extend across the gap from the first cushioning member to the second cushioning member, the sole plate extending away from the upper moving across the gap from the first cushioning member to the second cushioning member.

In some embodiments, the first cushioning member can be positioned in a heel region of the sole structure and the second cushioning member can be positioned in a forefoot region of the sole structure. The sole plate can be positioned between the first cushioning member and the upper, and/or the second cushioning member can be positioned between the sole plate and the upper.

In some embodiments, the sole plate can include a substantially planar rear portion coupled to the first cushioning member, an anterior curved portion coupled to the second cushioning member, and a posterior curved portion that spans the gap between the first cushioning member and the second cushioning member. The gap can extend along a non-linear path that can extend from a medial side of the sole structure to a lateral side of the sole structure

In some embodiments, the sole plate can be positioned within at least one of the first cushioning member and the second cushioning member. In some cases, the sole plate can be coupled to the first cushioning member.

According to yet another aspect of the disclosure, an article of footwear can include an upper and a sole structure that can extend between the upper and a ground surface. The sole structure can define a ground engaging surface and can include an outsole and a sole plate. The sole plate can be positioned between the upper and the outsole and can include a rear portion in a heel region, an anterior curved portion in a forefoot region, and a posterior curved portion extending away from the upper between the rear portion and the anterior curved portion.

In some embodiments, the article of footwear can further include a first cushioning member and a second cushioning member. The first cushioning member and the second cushioning member can be spaced apart from one another by a gap that can extend between the first cushioning member and the second cushioning member from a lateral side to a medial side. The first cushioning member can be positioned between the sole plate and the outsole, and the second cushioning member can be positioned between the sole plate and the upper. Each of the first cushioning member and the second cushioning member can be positioned between the sole plate and the outsole.

In some cases, the rear portion of the sole plate can be configured as a substantially planar portion and can be secured to at least one of the upper and the first cushioning member. The first cushioning member can define a U-shaped end and the sole plate can extend into the U-shaped end. In some cases, the sole plate can bifurcate at least one of the first cushioning member and the second cushioning member.

In some embodiments, the anterior curved portion of the sole plate can extend along the ground engaging surface.

According to still another aspect of the disclosure, a sole structure for an article of footwear having an upper can include a first cushioning member disposed in a heel region of the sole structure and a second cushioning member disposed in a forefoot region of the sole structure. The second cushioning member can be spaced apart from the first cushioning member in a midsole region of the sole structure by a gap that can extend between the first cushioning member and the second cushioning member from a lateral side of the sole structure to a medial side of the sole structure. The sole structure can further include a sole plate that can include a rear portion in the heel region, an anterior curved portion in the forefoot region, and a posterior curved portion extending between the rear portion and the anterior curved portion. The sole plate can extend away from the upper as the sole plate extends between the first cushioning member and the second cushioning member.

Other aspects of the article of footwear, including features and advantages thereof, will become apparent to one of ordinary skill in the art upon examination of the figures and detailed description herein. Therefore, all such aspects of the article of footwear are intended to be included in the detailed description and this summary.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **2** is a top, lateral side view of the sole structure of the article of footwear of FIG. **1**, the sole structure having a sole plate;

FIG. **3** is a lateral side view of the sole structure of FIG. **2**;

FIG. **4** is a bottom view of the sole structure of FIG. **2**;

FIG. **5** is a medial side view of the sole structure of FIG. **2**;

FIG. **6** is a cross-sectional view of the sole structure of FIG. **4** taken along line **6**-**6** thereof;

FIG. **7** is a top view of the sole structure of FIG. **2**;

FIG. **8** is a cross-sectional view of the sole structure of FIG. **4** taken along line **8**-**8** thereof;

FIG. **9** is a cross-sectional view of the sole structure of FIG. **4** taken along line **9**-**9** thereof;

FIG. **10** is a cross-sectional view of the sole structure of FIG. **4** taken along line **10**-**10** thereof;

FIG. **11** is a cross-sectional view of the sole structure of FIG. **4** taken along line **11**-**11** thereof;

FIG. **12** is a cross-sectional view of the sole structure of FIG. **4** taken along line **12**-**12** thereof;

FIG. **13** is an isometric view of the sole plate of the sole structure of FIG. **2**;

FIG. **14** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **15** is a top, lateral side view of the sole structure of the article of footwear of FIG. **14**, the sole structure having a sole plate;

FIG. **16** is a lateral side view of the sole structure of FIG. **15**;

FIG. **17** is a bottom view of the sole structure of FIG. **15**;

FIG. **18** is a medial side view of the sole structure of FIG. **15**;

FIG. **19** is a cross-sectional view of the sole structure of FIG. **17** taken along line **19-19** thereof;

FIG. **20** is a top view of the sole structure of FIG. **15**;

FIG. **21** is a cross-sectional view of the sole structure of FIG. **17** taken along line **21-21** thereof;

FIG. **22** is a cross-sectional view of the sole structure of FIG. **17** taken along line **22-22** thereof;

FIG. **23** is a cross-sectional view of the sole structure of FIG. **17** taken along line **23-23** thereof;

FIG. **24** is a cross-sectional view of the sole structure of FIG. **17** taken along line **24-24** thereof;

FIG. **25** is a cross-sectional view of the sole structure of FIG. **17** taken along line **25-25** thereof;

FIG. **26** is an isometric view of the sole plate of the sole structure of FIG. **15**;

FIG. **27** is a side view of the sole plate of FIG. **26**;

FIG. **28** is a top view of the sole plate of FIG. **26**;

FIG. **29** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to yet another embodiment of the disclosure;

FIG. **30** is a top, lateral side view of the sole structure of the article of footwear of FIG. **29**, the sole structure having a sole plate;

FIG. **31** is a lateral side view of the sole structure of FIG. **30**;

FIG. **32** is a bottom view of the sole structure of FIG. **30**;

FIG. **33** is a medial side view of the sole structure of FIG. **30**;

FIG. **34** is a cross-sectional view of the sole structure of FIG. **32** taken along line **34-34** thereof;

FIG. **35** is a top view of the sole structure of FIG. **30**;

FIG. **36** is a cross-sectional view of the sole structure of FIG. **32** taken along line **36-36** thereof;

FIG. **37** is a cross-sectional view of the sole structure of FIG. **32** taken along line **37-37** thereof;

FIG. **38** is a cross-sectional view of the sole structure of FIG. **32** taken along line **38-38** thereof;

FIG. **39** is a cross-sectional view of the sole structure of FIG. **32** taken along line **39-39** thereof;

FIG. **40** is a cross-sectional view of the sole structure of FIG. **32** taken along line **40-40** thereof;

FIG. **41** is an isometric view of the sole plate of the sole structure of FIG. **30**;

FIG. **42** is a side view of the sole plate of FIG. **41**;

FIG. **43** is a top view of the sole plate of FIG. **41**;

FIG. **44** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **45** is a top, lateral side view of the sole structure of the article of footwear of FIG. **44**, the sole structure having a sole plate;

FIG. **46** is a lateral side view of the sole structure of FIG. **45**;

FIG. **47** is a bottom view of the sole structure of FIG. **45**;

FIG. **48** is a medial side view of the sole structure of FIG. **45**;

FIG. **49** is a cross-sectional view of the sole structure of FIG. **47** taken along line **49-49** thereof;

FIG. **50** is a top view of the sole structure of FIG. **45**;

FIG. **51** is a cross-sectional view of the sole structure of FIG. **47** taken along line **51-51** thereof;

FIG. **52** is a cross-sectional view of the sole structure of FIG. **47** taken along line **52-52** thereof;

FIG. **53** is a cross-sectional view of the sole structure of FIG. **47** taken along line **53-53** thereof;

FIG. **54** is a cross-sectional view of the sole structure of FIG. **47** taken along line **54-54** thereof;

FIG. **55** is a cross-sectional view of the sole structure of FIG. **47** taken along line **55-55** thereof;

FIG. **56** is a lateral side view of an article of footwear configured as a left shoe that includes a sole structure, according to yet another embodiment of the disclosure;

FIG. **57** is a bottom view of the sole structure of FIG. **56**;

FIG. **58** is a medial side view of the sole structure of FIG. **56**;

FIG. **59** is a cross-sectional view of the sole structure of FIG. **57** taken along line **59-59** thereof;

FIG. **60** is a top view of the sole structure of FIG. **56**;

FIG. **61** is a cross-sectional view of the sole structure of FIG. **57** taken along line **61-61** thereof;

FIG. **62** is a cross-sectional view of the sole structure of FIG. **57** taken along line **62-62** thereof;

FIG. **63** is a cross-sectional view of the sole structure of FIG. **57** taken along line **63-63** thereof;

FIG. **64** is a cross-sectional view of the sole structure of FIG. **57** taken along line **64-64** thereof;

FIG. **65** is a cross-sectional view of the sole structure of FIG. **56** taken along line **65-65** thereof;

FIG. **66** is a lateral side view of an article of footwear configured as a left shoe that includes a sole structure, according to another embodiment of the disclosure;

FIG. **67** is a bottom view of the sole structure of FIG. **66**;

FIG. **68** is a medial side view of the sole structure of FIG. **66**;

FIG. **69** is a cross-sectional view of the sole structure of FIG. **67** taken along line **69-69** thereof;

FIG. **70** is a top view of the sole structure of FIG. **66**;

FIG. **71** is a cross-sectional view of the sole structure of FIG. **67** taken along line **71-71** thereof;

FIG. **72** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **73** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **74** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **75** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **76** is a lateral side view of an article of footwear configured as a left shoe that includes a sole structure, according to yet another embodiment of the disclosure;

FIG. **77** is a bottom view of the sole structure of FIG. **76**;

FIG. **78** is a medial side view of the sole structure of FIG. **76**;

FIG. **79** is a cross-sectional view of the sole structure of FIG. **77** taken along line **79-79** thereof;

FIG. **80** is a top view of the sole structure of FIG. **76**;

FIG. **81** is a cross-sectional view of the sole structure of FIG. **77** taken along line **81-81** thereof;

FIG. **82** is a cross-sectional view of the sole structure of FIG. **77** taken along line **81-81** thereof;

FIG. **83** is a cross-sectional view of the sole structure of FIG. **77** taken along line **82-82** thereof;

FIG. **84** is a cross-sectional view of the sole structure of FIG. **77** taken along line **83-83** thereof;

FIG. **85** is a cross-sectional view of the sole structure of FIG. **77** taken along line **84-84** thereof;

FIG. **86** is an isometric view of the sole plate for use with the sole structures of FIG. **56**, **66**, or **76**;

FIG. **87** is a top plan view of the sole plate of FIG. **86**;

FIG. **88** is an isometric view of another plate for use with the sole structures of FIGS. **66** and **76**;

FIG. **89** is a top plan view of the plate of FIG. **88**;

FIG. **90** schematically depicts a mean relative maximum oxygen uptake relative to a velocity of a runner, according to one or more aspects described herein;

FIG. **91** schematically depicts a mean heart rate relative to velocity of a runner, according to the aspects described herein;

FIG. **92** schematically depicts a mean rating of perceived exertion relative to a velocity of a runner, according to the aspects described herein;

FIG. **93** schematically depicts a mean lactate concentration relative to a velocity of a runner, according to the aspects described herein; and

FIG. **94** schematically depicts a regression analysis comparing a rate of feeling to a lactate concentration, according to the aspects described herein.

DETAILED DESCRIPTION OF THE DRAWINGS

The following discussion and accompanying figures disclose various embodiments or configurations of a shoe and a sole structure. Although embodiments of a shoe or sole structure are disclosed with reference to a sports shoe, such as a running shoe, tennis shoe, basketball shoe, etc., concepts associated with embodiments of the shoe or the sole structure may be applied to a wide range of footwear and footwear styles, including cross-training shoes, football shoes, golf shoes, hiking shoes, hiking boots, ski and snowboard boots, soccer shoes and cleats, walking shoes, and track cleats, for example. Concepts of the shoe or the sole structure may also be applied to articles of footwear that are considered non-athletic, including dress shoes, sandals, loafers, slippers, and heels. In addition to footwear, particular concepts described herein may also be applied and incorporated in other types of apparel or other athletic equipment, including helmets, padding or protective pads, shin guards, and gloves. Even further, particular concepts described herein may be incorporated in cushions, backpack straps, golf clubs, or other consumer or industrial products. Accordingly, concepts described herein may be utilized in a variety of products.

The term "about," as used herein, refers to variation in the numerical quantity that may occur, for example, through typical measuring and manufacturing procedures used for articles of footwear or other articles of manufacture that may include embodiments of the disclosure herein; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or mixtures or carry out the methods; and the like. Throughout the disclosure, the terms "about" and "approximately" refer to a range of values ±5% of the numeric value that the term precedes.

The terms "weight percent," "wt-%," "percent by weight," "% by weight," and variations thereof, as used herein, refer to the concentration of a substance or component as the weight of that substance or component divided by the total weight, for example, of the composition or of a particular component of the composition, and multiplied by

100. It is understood that, as used herein, "percent," "%," and the like may be synonymous with "weight percent" and "wt-%."

The present disclosure is directed to an article of footwear and/or specific components of the article of footwear, such as an upper and/or a sole or sole structure. The upper may comprise a knitted component, a woven textile, and/or a non-woven textile. The knitted component may be made by knitting of yarn, the woven textile by weaving of yarn, and the non-woven textile by manufacture of a unitary non-woven web. Knitted textiles include textiles formed by way of warp knitting, weft knitting, flat knitting, circular knitting, and/or other suitable knitting operations. The knit textile may have a plain knit structure, a mesh knit structure, and/or a rib knit structure, for example. Woven textiles include, but are not limited to, textiles formed by way of any of the numerous weave forms, such as plain weave, twill weave, satin weave, dobbin weave, jacquard weave, double weaves, and/or double cloth weaves, for example. Non-woven textiles include textiles made by air-laid and/or spun-laid methods, for example. The upper may comprise a variety of materials, such as a first yarn, a second yarn, and/or a third yarn, which may have varying properties or varying visual characteristics.

FIGS. **1-12** depict an exemplary embodiment of an article of footwear **100** including an upper **102** and a sole structure **104**. The upper **102** is attached to the sole structure **104** and together define an interior cavity into which a foot may be inserted. For reference, the article of footwear **100** defines a forefoot region **108**, a midfoot region **110**, and a heel region **112**. The forefoot region **108** generally corresponds with portions of the article of footwear **100** that encase portions of the foot that includes the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **110** is proximate and adjoining the forefoot region **108**, and generally corresponds with portions of the article of footwear **100** that encase the arch of foot, along with the bridge of the foot. The heel region **112** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

Many conventional footwear uppers are formed from multiple elements (e.g., textiles, polymer foam, polymer sheets, leather, and synthetic leather) that are joined through bonding or stitching at a seam. In some embodiments, the upper **102** of the article of footwear **100** is formed from a knitted structure or knitted components. In various embodiments, a knitted component may incorporate various types of yarn that may provide different properties to an upper. For example, one area of the upper **102** may be formed from a first type of yarn that imparts a first set of properties, and another area of the upper **102** may be formed from a second type of yarn that imparts a second set of properties. Using this configuration, properties of the upper **102** may vary throughout the upper **102** by selecting specific yarns for different areas of the upper **102**.

The article of footwear **100** also includes a medial side **116** (e.g., see FIG. **3**) and a lateral side **118** (e.g., see FIG. **5**). In particular, the lateral side **118** corresponds to an outside portion of the article of footwear **100** and the medial side **116** corresponds to an inside portion of the article of footwear **100**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **116** are closest to one another when a user is wearing the articles of footwear **100**, while the lateral sides **118** are defined as the sides that are farthest from one another while

being worn. The medial side **116** and the lateral side **118** adjoin one another at opposing, distal ends of the article of footwear **100**.

Unless otherwise specified, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** are intended to define boundaries or areas of the article of footwear **100**. To that end, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** generally characterize sections of the article of footwear **100**. Further, both the upper **102** and the sole structure **104** may be characterized as having portions within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**. Therefore, the upper **102** and the sole structure **104**, and/or individual portions of the upper **102** and the sole structure **104**, may include portions thereof that are disposed within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**.

The sole structure **104** is connected or secured to the upper **102** and extends between a foot of a user and the ground when the article of footwear **100** is worn by the user. The sole structure **104** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **104** of the present embodiment of the invention includes one or more components that provide the sole structure **104** with preferable spring and damping properties.

The sole structure **104** includes an outsole **130**, a first cushioning member **132**, a second cushioning member **134**, and a sole plate **136** (see FIG. **6**). The outsole **130** may define a bottom end or surface of the sole structure **104** across the heel region **112**, the midfoot region **110**, and the forefoot region **108**. Further, the outsole **130** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **104** and may be opposite of the insole thereof. The outsole **130** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **104**. In some embodiments, the outsole **130** may be formed from rubber, for example.

The first cushioning member **132** may be positioned adjacent to and on top of the outsole **130** in the heel region **112**, and positioned adjacent to and on top of the second cushioning member **134** in the midfoot region **110** and forefoot region **108**. The first cushioning member **132** may include one or more longitudinal grooves or flex lines **138** that extend between the medial side **116** and the lateral side **118**, which segments the first cushioning member **132** in the heel region **112**. For example, in the particular embodiment shown in FIGS. **1-12**, the first cushioning member **132** includes five flex lines **138**, which define four flex regions **140**. Further, as best shown in FIG. **4**, the flex lines **138** may have a sinusoidal shape between the medial side **116** and the lateral side **118**.

The second cushioning member **134** may be positioned adjacent to and on top of the outsole **130** in the midfoot region **110** and forefoot region **108**. As will be further discussed herein, the second cushioning member **134** may also be positioned between or be enclosed within the sole plate **136** in the midfoot region **110** and/or the forefoot region **108** (see FIG. **6**).

The first cushioning member **132** and/or the second cushioning member **134** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **132** and/or the second cushioning member **134** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **132** and/or the second cushioning member **134** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **132** and/or the second cushioning member **134** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **132** and, more preferably, the second cushioning member **134**. In further embodiments, the first cushioning member **132** and/or the second cushioning member **134** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **132** and/or the second cushioning member **134** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **104** further includes the sole plate **136**, which as best shown in FIG. **13**, includes an upper flange **150** and a lower flange **152** and an arched, curved, or C-shaped rear portion **154** that connects the upper flange **150** and the lower flange **152**. Further, a gap **156** extends between the upper flange **150** and the lower flange **152**, into which the second cushioning member **134** may be positioned, as previously discussed herein. As shown in FIG. **6**, the sole plate **136** extends at least partially through the midfoot region **110** and at least partially through the forefoot region **108**. As further illustrated in FIG. **6**, the rear portion **154** of the sole plate **136** may be spaced from a rear side of the second cushioning member **134**, which creates a spacing **158** therebetween.

With continued reference to FIG. **6**, the lower flange **152** may be adjacent to and positioned between the outsole **130** and the second cushioning member **134**, and the upper flange **150** may be adjacent to and positioned between the second cushioning member **134** and the first cushioning member **132**. In some embodiments, the sole plate **136** has

a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **136** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **136** can include carbon fiber, for example.

In some embodiments, the outsole **130** or the ground-engaging surface is not continuous along the article of footwear **100**. For example, as best shown in FIG. **6**, there is a spacing **158**, or an absence of a ground-engaging surface, along the article of footwear **100**, which is located within the midfoot region **110** of the article of footwear **100**.

FIGS. **14-25** show another configuration of an article of footwear **200**. Similar to the sole structure **104**, the sole structure **204** is configured to be attached to an upper **202** and together define an interior cavity into which a foot may be inserted. For reference, the sole structure **204** defines a forefoot region **208**, a midfoot region **210**, and a heel region **212**. The forefoot region **208** generally corresponds with portions of an article of footwear, such as the article of footwear **200**, for example, that encase portions of the foot that include the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **210** is proximate and adjoining the forefoot region **208**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **212** is proximate and adjoining the midfoot region **210** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

The article of footwear **200** also includes a medial side **216** (e.g., see FIG. **18**) and a lateral side **218** (e.g., see FIG. **16**). In particular, the lateral side **218** corresponds to an outside portion of the article of footwear **200** and the medial side **216** corresponds to an inside portion of the article of footwear **200**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **216** are closest to one another when a user is wearing the articles of footwear **200**, while the lateral sides **218** are defined as the sides that are farthest from one another while being worn. The medial side **216** and the lateral side **218** adjoin one another at opposing, distal ends of the article of footwear **200**.

Unless otherwise specified, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** are intended to define boundaries or areas of the article of footwear **200**. To that end, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** generally characterize sections of the article of footwear **200**. Further, both the upper **202** and the sole structure **204** may be characterized as having portions within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**. Therefore, the upper **202** and the sole structure **204**, and/or individual portions of the upper **202** and the sole structure **204**, may include portions thereof that are disposed within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**.

The sole structure **204** is connected or secured to the upper **202** and extends between a foot of a user and the ground when the article of footwear **200** is worn by the user. The sole structure **204** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **204** of the present embodiment of the invention includes one or more components that provide the sole structure **204** with preferable spring and damping properties.

The sole structure **204** includes an outsole **230**, a first cushioning member **232**, a second cushioning member **234**, and a sole plate **236** (see FIG. **19**). The outsole **230** may define a bottom end or surface of the sole structure **204** across the heel region **212**, the midfoot region **210**, and the forefoot region **208**. Further, the outsole **230** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **204** and may be opposite of the insole thereof. The outsole **230** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **204**. In some embodiments, the outsole **230** may be formed from rubber, for example.

The first cushioning member **232** may be positioned adjacent to and on top of the outsole **230** in the heel region **212**, and positioned adjacent to and on top of the second cushioning member **234** in the midfoot region **210** and forefoot region **208**. The first cushioning member **232** may include one or more longitudinal grooves or flex lines **238** that extend between the medial side **216** and the lateral side **218**, which segments the first cushioning member **232** in the heel region **212**. For example, in the particular embodiment shown in FIGS. **14-25**, the first cushioning member **232** includes five flex lines **238**, which define four flex regions **240**. Further, as best shown in FIG. **17**, the flex lines **238** may have a sinusoidal shape between the medial side **216** and the lateral side **218**.

The second cushioning member **234** may be positioned adjacent to and on top of the outsole **230** in the midfoot region **210** and forefoot region **208**. As will be further discussed herein, the second cushioning member **234** may also be positioned between or be enclosed within the sole plate **236** in the forefoot region **208** (see FIG. **19**).

The first cushioning member **232** and/or the second cushioning member **234** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **232** and/or the second cushioning member **234** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **232** and/or the second cushioning member **234** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **232** and/or the second cushioning member **234** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized

container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **232** and, more preferably, the second cushioning member **234**. In further embodiments, the first cushioning member **232** and/or the second cushioning member **234** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **232** and/or the second cushioning member **234** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **204** further includes the sole plate **236**, which is best shown in FIGS. **26-28**, includes an upper flange **250** and a lower flange **252** that connect at a vertex point **254**. Further, a gap **256** extends between the upper flange **250** and the lower flange **252**, into which the second cushioning member **234** may be positioned, as previously discussed herein. As shown in FIG. **19**, the sole plate **236** extends through the forefoot region **208**. As further illustrated in FIG. **19**, the vertex point **254** may be spaced from a front side of the second cushioning member **234**, which creates a spacing or gap **258** between the upper flange **250** and the lower flange **252**.

With continued reference to FIG. **19**, a rear portion of the lower flange **252** may be adjacent to and positioned between the outsole **230** and the second cushioning member **234**, and a rear portion of the upper flange **250** may be adjacent to and positioned between the second cushioning member **234** and the first cushioning member **232**. In some embodiments, the sole plate **236** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

With reference to FIGS. **26** and **28**, the upper flange **250** and the lower flange **252** may also include one or more cut-out portions **260**, **262**. The cut-out portions **260**, **262** may be advantageous to allow the medial and lateral sides of the sole plate **236** to flex independent of one another.

In some embodiments, the sole plate **236** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **236** can include carbon fiber, for example.

In some embodiments, the outsole **230** or the ground-engaging surface is not continuous along the article of footwear **200**. For example, as best shown in FIG. **19**, there is a spacing **264**, or an absence of a ground-engaging surface, along the article of footwear **200**, which is located within the midfoot region **210** of the article of footwear **200**.

FIGS. **29-40** show another configuration of an article of footwear **300**. Similar to the sole structures **104**, **204**, the sole structure **304** is configured to be attached to an upper **302** and together define an interior cavity into which a foot may be inserted. For reference, the sole structure **304** defines a forefoot region **308**, a midfoot region **310**, and a heel region **312**. The forefoot region **308** generally corresponds

with portions of an article of footwear, such as the article of footwear **300**, for example, that encase portions of the foot that include the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **310** is proximate and adjoining the forefoot region **308**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **312** is proximate and adjoining the midfoot region **310** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

The article of footwear **300** also includes a medial side **316** (e.g., see FIG. **33**) and a lateral side **318** (e.g., see FIG. **31**). In particular, the lateral side **318** corresponds to an outside portion of the article of footwear **300** and the medial side **316** corresponds to an inside portion of the article of footwear **300**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **316** are closest to one another when a user is wearing the articles of footwear **300**, while the lateral sides **318** are defined as the sides that are farthest from one another while being worn. The medial side **316** and the lateral side **318** adjoin one another at opposing, distal ends of the article of footwear **300**.

Unless otherwise specified, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** are intended to define boundaries or areas of the article of footwear **300**. To that end, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** generally characterize sections of the article of footwear **300**. Further, both the upper **302** and the sole structure **304** may be characterized as having portions within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**. Therefore, the upper **302** and the sole structure **304**, and/or individual portions of the upper **302** and the sole structure **304**, may include portions thereof that are disposed within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**.

The sole structure **304** is connected or secured to the upper **302** and extends between a foot of a user and the ground when the article of footwear **300** is worn by the user. The sole structure **304** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **304** of the present embodiment of the invention includes one or more components that provide the sole structure **304** with preferable spring and damping properties.

The sole structure **304** includes an outsole **330**, a first cushioning member **332**, a second cushioning member **334**, and a sole plate **336** (see FIG. **34**). The outsole **330** may define a bottom end or surface of the sole structure **304** across the heel region **312**, the midfoot region **310**, and the forefoot region **308**. Further, the outsole **330** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **304** and may be opposite of the insole thereof. The outsole **330** may be formed from one or more materials to impart durability, wear-resistance, abra-

sion resistance, or traction to the sole structure **304**. In some embodiments, the outsole **330** may be formed from rubber, for example.

The first cushioning member **332** may be positioned adjacent to and on top of the outsole **330** in the heel region **312**. The first cushioning member **332** may also be positioned adjacent to and below the sole plate **336**. The first cushioning member **332** may include one or more longitudinal grooves or flex lines **338** that extend between the medial side **316** and the lateral side **318**, which segments the first cushioning member **332** in the heel region **312**. For example, in the particular embodiment shown in FIGS. **29-40**, the first cushioning member **332** includes five flex lines **338**, which define four flex regions **340**. Further, as best shown in FIG. **32**, the flex lines **338** may have a sinusoidal shape between the medial side **316** and the lateral side **318**.

The second cushioning member **334** may be positioned adjacent to and on top of the outsole **330** in the midfoot region **310** and forefoot region **308**. As will be further discussed herein, the sole plate **336** may also bifurcate the second cushioning member **334**, such that the sole plate **336** is positioned within the second cushioning member **334** (see FIG. **34**).

The first cushioning member **332** and/or the second cushioning member **334** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **332** and/or the second cushioning member **334** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **332** and/or the second cushioning member **334** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **332** and/or the second cushioning member **334** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **332** and, more preferably, the second cushioning member **334**. In further embodiments, the first cushioning member **332** and/or the second cushioning member **334** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **332** and/or the second cushioning member **334** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **304** further includes the sole plate **336**, which as best shown in FIGS. **41-43**, includes a curved portion **350** and a rear portion **352**, which may be relatively planar. The curved portion **350** may also include an anterior curved portion **354** and a posterior curved portion **356**. The anterior curved portion **354** and the posterior curved portion **356** may each individually include one or more radii of curvature.

With reference to FIG. **34**, the curved portion **350** of the plate **336** may be positioned within the second cushioning member **334** and the rear portion **352** of the plate **336** may be positioned above the first cushioning member **332**. Further, a portion of the posterior curved portion **356** may extend between a gap **358** between the first cushioning member **332** and the second cushioning member **334**. Resultantly, in this embodiment, a portion of the plate **336** does not include a cushioning member—such as the first cushioning member **332** or the second cushioning member **334**—above, below, or between the plate **336**. Thus, the plate **336** is spaced from the upper **302** and a gap, or absence of material, is present between the plate **336** and the upper **302** approximate the midfoot region **310** and/or the heel region **312** (see FIG. **29**). In some embodiments, the sole plate **336** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **336** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **336** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **330** or the ground-engaging surface is not continuous along the article of footwear **300**. For example, as best shown in FIG. **34**, there is a spacing or gap **358**, or an absence of a ground-engaging surface, along the article of footwear **300**, which is located within the midfoot region **310** of the article of footwear **300**.

FIGS. **44-55** show another configuration of an article of footwear **400**. Similar to the sole structures **104**, **204**, **304**, the sole structure **404** is configured to be attached to an upper **402** and together define an interior cavity into which a foot may be inserted. Like the other sole structures, the sole structure **404** can be defined by a forefoot region **408**, a midfoot region **410**, a heel region **412**, as well as a medial side **416** (see FIG. **48**) and a lateral side **418** (see FIG. **46**). Like the other embodiments described herein, unless otherwise specified, the forefoot region, the midfoot region, the heel region, the medial side **416**, and the lateral side **418** are intended to define boundaries or areas of the article of footwear **400**. To that end, the forefoot region, the midfoot region, the heel region, the medial side **416**, and the lateral side **418** generally characterize sections of the article of footwear **400**. Further, both the upper **402** and the sole structure **404** may be characterized as having portions within the forefoot region **408**, the midfoot region **410**, the heel region **412**, and on the medial side **416** and the lateral side **418**. Therefore, the upper **402** and the sole structure **404**, and/or individual portions of the upper **402** and the sole structure **404**, may include portions thereof that are disposed within the forefoot region **408**, the midfoot region **410**, the heel region **412**, and on the medial side **416** and the lateral side **418**.

The sole structure **404** is connected or secured to the upper **402** and extends between a foot of a user and the ground when the article of footwear **400** is worn by the user. The sole structure **404** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **404** of the present embodiment of the invention includes one or more components that provide the sole structure **404** with preferable spring and damping properties.

The sole structure **404** includes an outsole **430**, a first cushioning member **432**, a second cushioning member **434**, and a sole plate **436** (see FIG. **49**). The outsole **430** may define a bottom end or surface of the sole structure **404** across the heel region **412**, the midfoot region **410**, and the forefoot region **408**. Further, the outsole **430** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **404** and may be opposite of the insole thereof. The outsole **430** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **404**. In some embodiments, the outsole **430** may be formed from rubber, for example.

The first cushioning member **432** may be positioned adjacent to and on top of the outsole **430** in the heel region **412**, and positioned adjacent to and on top of the second cushioning member **434** in the midfoot region **410** and forefoot region **408**. The first cushioning member **432** may include one or more longitudinal grooves or flex lines **438** that extend between the medial side **416** and the lateral side **418**, which segments the first cushioning member **432** in the heel region **412**. For example, in the particular embodiment shown in FIGS. **44-55**, the first cushioning member **432** includes five flex lines **438**, which define four flex regions **440**. Further, as best shown in FIG. **47**, the flex lines **438** may have a sinusoidal shape between the medial side **416** and the lateral side **418**.

The second cushioning member **434** may be positioned adjacent to and on top of the outsole **430** in the midfoot region **410** and forefoot region **408**. As will be further discussed herein, the second cushioning member **434** may also be positioned between or be enclosed within the sole plate **436** in the forefoot region **408** (see FIG. **49**).

The first cushioning member **432** and/or the second cushioning member **434** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **432** and/or the second cushioning member **434** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **432** and/or the second cushioning member **434** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **432** and/or the second cushioning member **434** is formed from a

supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **432** and, more preferably, the second cushioning member **434**. In further embodiments, the first cushioning member **432** and/or the second cushioning member **434** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **432** and/or the second cushioning member **434** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **404** further includes the sole plate **436**, which as best shown in FIGS. **49** and **50**, is a relatively planar structure having a first cut-out portion **450** near a front end thereof and a second cut-out portion **452** near a rear end thereof.

With particular reference to FIG. **49**, the plate **436** may be positioned above the first cushioning member **432** in the midfoot region **410**. In some embodiments, the sole plate **436** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.8 centimeters.

In some embodiments, the sole plate **436** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **436** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **430** or the ground-engaging surface is not continuous along the article of footwear **400**. For example, as best shown in FIG. **49**, there is a spacing or gap **458**, or an absence of a ground-engaging surface, along the article of footwear **400**, which is located within the midfoot region **410** of the article of footwear **400**.

FIGS. **56-65** show another configuration of an article of footwear **500** having an upper **502** and a sole structure **504**. Similar to the sole structures **104**, **204**, **304**, **404**, the sole structure **504** is configured to be attached to the upper **502** and together define an interior cavity into which a foot may be inserted. Also similar to the other sole structures, the sole structure **504** includes a forefoot region **508**, a midfoot region **510**, a heel region **512**, a medial side **516** (see FIG. **58**) and a lateral side **518** (see FIG. **56**). Unless otherwise specified, the forefoot region **508**, the midfoot region **510**, the heel region **512**, the medial side **516**, and the lateral side **518** are intended to define boundaries or areas of the article of footwear **500**. Further, as will be further discussed herein, the sole structure **504** of the present embodiment of the

invention includes one or more components that provide the sole structure **504** with preferable spring and damping properties.

The sole structure **504** also includes an outsole **530**, a first cushioning member **532**, a second cushioning member **534**, and a sole plate **536** (see FIG. **59**). The first cushioning member **532** may be positioned adjacent to and on top of the outsole **530** in the heel region **512**. The first cushioning member **532** may also be positioned adjacent to and below the sole plate **536**. The first cushioning member **532** may include one or more longitudinal grooves or flex lines **538** that extend between the medial side **516** and the lateral side **518**, which segments the first cushioning member **532** in the heel region **512**.

The second cushioning member **534** may be positioned adjacent to and on top of the outsole **530** in the midfoot region **510** and forefoot region **508**. As will be further discussed herein, the sole plate **536** may also extend between the second cushioning member **534** and the outsole **530** (see FIG. **59**). The first cushioning member **532** and/or the second cushioning member **534** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **532** and/or the second cushioning member **534** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **532** and/or the second cushioning member **534** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

The sole structure **504** further includes the sole plate **536**, which as best shown in FIG. **59**, includes a curved portion **550** and a rear portion **552**, which may be relatively planar. The curved portion **550** may also include an anterior curved portion **554** and a posterior curved portion **556**. The anterior curved portion **554** and the posterior curved portion **556** may each individually include one or more radii of curvature.

With reference to FIG. **59**, the curved portion **550** of the plate **536** may be positioned below the second cushioning member **534** and the rear portion **552** of the plate **536** may be positioned above the first cushioning member **532**. Further, a portion of the posterior curved portion **556** may extend between a gap **558** between the first cushioning member **532** and the second cushioning member **534**. In some embodiments, the sole plate **536** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters. In some embodiments, the sole plate **536** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **536** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **530** or the ground-engaging surface is not continuous along the article of footwear **500**. For example, as best shown in FIG. **59**, there is a spacing or gap **558**, or an absence of a ground-engaging surface, along the article of footwear **500**, which is located within the midfoot region **510** and/or the heel region **512** of the article of footwear **500**. In this embodiment, similar to the plate **336**, a portion of the plate **536** does not include a cushioning member—such as the first cushioning member **532** or the second cushioning member **534**—above, below, or between the plate **536**. Thus, the plate **536** is spaced from the upper **502** and a gap, or absence of material, is present between the plate **536** and the upper **502** approximate the midfoot region **510** and/or the heel region **512** (see FIG. **59**).

In some embodiments, the sole structure **504** may also include a second plate **560**. In the particular embodiment shown in FIGS. **56-65**, the second plate **560** encases the sole plate **536** such that the sole plate **536** sits within the second plate **560**. Additionally, as best shown in FIG. **59**, the second plate **560** extends across the forefoot region **508**, the midfoot region **510**, and the heel region **512**. Thus, the second plate **560** is positioned below the sole plate **536** across an entire length thereof. In other embodiments, as will be further discussed herein, the second plate **560** may only extend across a portion of the sole plate **536** and may be positioned at a location along the sole structure **504** where the sole plate **536** needs targeted structural support. The second plate **560** may be constructed from similar materials to the sole plate **536**, which have already been discussed herein. However, in particular embodiments, the material used to construct the second plate **560** may also differ from the material used to construct the sole plate **536** such that the second plate **560** provides added reinforcement to the sole plate **536**. For example, in one embodiment, the sole plate **536** may be constructed from a carbon fiber material and the second plate **560** may be constructed from thermoplastic polyurethane (TPU) to support the sole plate **536**. Additionally, the second plate **560** may support the structural integrity of the sole plate **536** and prevent the sole plate **536** from fracturing during use thereof.

In addition to the second plate **560**, an amount of material may be injected into one or more grooves of the sole plate **536**. More particularly, in this embodiment, the sole plate **536** may include two grooves **562** (see FIG. **63**) and a material **564** may be injected or positioned within the grooves **562**. Similar to the second plate **560**, the material injected into the grooves **562** may provide further structural support to the sole plate **536** and targeted support to the sole plate **536**. For example, in this particular embodiment, the grooves are provided across the midfoot or arch region of the sole structure **504**, and therefore, the material **564** may provide support to the sole plate **536** in the arch region thereof, which thereby provides further support to a user's foot in the arch region of the sole structure **504**. The injected material **564** may be a suitable plastic material, such as thermoplastic polyurethane (TPU) or the like.

FIGS. **66-75** show another configuration of an article of footwear **600** having an upper **602** and a sole structure **604**. Similar to the sole structures **104**, **204**, **304**, **404**, **504** the sole structure **604** is configured to be attached to the upper **602** and together define an interior cavity into which a foot may be inserted. The sole structure **604**, similar to the other sole structures, includes a forefoot region **608**, a midfoot region **610**, a heel region **612**, a medial side **616** (see FIG. **68**) and a lateral side **618** (see FIG. **66**). Unless otherwise specified, the forefoot region **608**, the midfoot region **610**, the heel region **612**, the medial side **616**, and the lateral side **618** are intended to define boundaries or areas of the article of footwear **600**.

The sole structure **604** also includes an outsole **630**, a first cushioning member **632**, a second cushioning member **634**, and a sole plate **636** (see FIG. **69**). The outsole **630** may

define a bottom end or surface of the sole structure **604** across the heel region **612**, the midfoot region **610**, and the forefoot region **608**.

The first cushioning member **632** may be positioned adjacent to and on top of the outsole **630** in the heel region **612**. The first cushioning member **632** may also be positioned adjacent to and below the sole plate **636**. The first cushioning member **632** may include one or more longitudinal grooves or flex lines **638** that extend between the medial side **616** and the lateral side **618**, which segments the first cushioning member **632** in the heel region **612**.

The second cushioning member **634** may be positioned adjacent to and on top of the outsole **630** in the midfoot region **610** and forefoot region **608**. As will be further discussed herein, the sole plate **636** may also bifurcate the second cushioning member **634**, such that the sole plate **636** is positioned within the second cushioning member **634** (see FIG. **69**).

The first cushioning member **632** and/or the second cushioning member **634** may be individually constructed from similar materials to those already disclosed in connection with the other embodiments disclosed herein.

The sole structure **604** further includes the sole plate **636**, which as best shown in FIGS. **69**, includes a curved portion **650** and a rear portion **652**, which may be relatively planar. The curved portion **650** may also include an anterior curved portion **654** and a posterior curved portion **656**. The anterior curved portion **654** and the posterior curved portion **656** may each individually include one or more radii of curvature.

With reference to FIG. **69**, the curved portion **650** of the plate **636** may be positioned within the second cushioning member **634** and the rear portion **652** of the plate **636** may be positioned above the first cushioning member **632**. Further, a portion of the posterior curved portion **656** may extend between a gap **658** between the first cushioning member **632** and the second cushioning member **634**. In some embodiments, the sole plate **636** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **636** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **636** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **630** or the ground-engaging surface is not continuous along the article of footwear **600**. For example, as best shown in FIG. **69**, there is a spacing or gap **658**, or an absence of a ground-engaging surface, along the article of footwear **600**, which is located within the midfoot region **610** of the article of footwear **600**.

Similar to the sole structure **504**, the sole structure **604** may also include a second plate **660**. In the particular embodiment shown in FIGS. **66-75**, the second plate **660** partially encases the sole plate **636** such that the sole plate **636** sits within the second plate **660**. Additionally, as best shown in FIG. **69**, the second plate **660** extends across the midfoot region **610** and the heel region **610**. Thus, the second plate **660** is positioned below the sole plate **636** across a portion of the sole plate **636**, and more particularly, the arch or midfoot region thereof. In other embodiments, as previously discussed herein, the second plate **660** may extend across an entire length of the sole plate **636** or may be positioned at a location along the sole structure **604** where the sole plate **636** needs targeted structural support. The second plate **660** may be constructed from similar materials to the sole plate **636**, which have already been discussed herein. However, in particular embodiments, the material used to construct the second plate **660** may differ from the material used to construct the sole plate **636** such that the second plate **660** provides added reinforcement to the sole plate **636**. For example, in one embodiment, the sole plate **636** may be constructed from a carbon fiber material and the second plate **660** may be constructed from thermoplastic polyurethane (TPU) to support the sole plate **636**. Additionally, the second plate **660** may support the structural integrity of the sole plate **636** and prevent the sole plate **636** from fracturing during use thereof.

In addition to the second plate **660**, an amount of material may be injected into one or more grooves of the sole plate **636**. More particularly, in this embodiment, the sole plate **636** may include two grooves **662** (see FIG. **73**) and material **664** may be injected or positioned within the grooves **662**. Similar to the second plate **660**, the material injected into the grooves **662** may provide further structural support to the sole plate **636** and targeted support to the sole plate **636**. For example, in this particular embodiment, the grooves are provided across the midfoot or arch region of the sole structure **604**, and therefore, the material **664** may provide support to the sole plate **636** in the arch region thereof, which thereby provides further support to a user's foot in the arch region of the sole structure **604**. The injected material **664** may be a suitable plastic material, such as thermoplastic polyurethane (TPU) or the like.

FIGS. **76-85** show another configuration of an article of footwear **700** having an upper **702** and a sole structure **704**. Similar to the sole structures **104**, **204**, **304**, **404**, **504**, **604** the sole structure **704** is configured to be attached to the upper **702** and together define an interior cavity into which a foot may be inserted. Further, the sole structure **704** includes a forefoot region **708**, a midfoot region **710**, a heel region **712**, a medial side **716** (see FIG. **78**), and a lateral side **718** (see FIG. **76**). Unless otherwise specified, the forefoot region **708**, the midfoot region **710**, the heel region **712**, the medial side **716**, and the lateral side **718** are intended to define boundaries or areas of the article of footwear **700**.

The sole structure **704** includes an outsole **730**, a first cushioning member **732**, a second cushioning member **734**, and a sole plate **736** (see FIG. **79**). The outsole **730** may define a bottom end or surface of the sole structure **704** across the heel region **712**, the midfoot region **710**, and the forefoot region **708**.

The first cushioning member **732** may be positioned adjacent to and on top of the outsole **730** in the heel region **712**. The first cushioning member **732** may also be positioned adjacent to and below the sole plate **736**. The first cushioning member **732** may include one or more longitudinal grooves or flex lines **738** that extend between the medial side **716** and the lateral side **718**, which segments the first cushioning member **732** in the heel region **712**.

The second cushioning member **734** may be positioned adjacent to and on top of the outsole **730** in the midfoot region **710** and forefoot region **708**. As will be further discussed herein, the sole plate **736** may also bifurcate the second cushioning member **734**, such that the sole plate **736** is positioned within the second cushioning member **734** (see FIG. **79**). Further, the sole plate **736** may also bifurcate the first cushioning member **732**, such that the sole plate **736** is positioned within the first cushioning member as well (see FIG. **79**).

The first cushioning member **732** and/or the second cushioning member **734** may be individually constructed

from similar materials to the first and second cushioning members of the other embodiments.

The sole structure **704** also includes the sole plate **736**, which as best shown in FIG. **79**, includes a curved portion **750** and a rear portion **752**, which may be relatively planar. The curved portion **750** may also include an anterior curved portion **754** and a posterior curved portion **756**. The anterior curved portion **754** and the posterior curved portion **756** may each individually include one or more radii of curvature.

With reference to FIG. **79**, the curved portion **750** of the plate **736** may be positioned within the second cushioning member **734** and the rear portion **752** of the plate **736** may be positioned above the first cushioning member **732**. Further, a portion of the posterior curved portion **756** may extend between a gap **758** between the first cushioning member **732** and the second cushioning member **734**. In some embodiments, the sole plate **736** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **736** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **736** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **730** or the ground-engaging surface is not continuous along the article of footwear **700**. For example, as best shown in FIG. **79**, there is a spacing or gap **758**, or an absence of a ground-engaging surface, along the article of footwear **700**, which is located within the midfoot region **710** of the article of footwear **700**.

Similar to the sole structures **504**, **604**, the sole structure **704** may also include a second plate **760**. In the particular embodiment shown in FIGS. **76-85**, the second plate **760** partially encases the sole plate **736** such that the sole plate **736** sits within the second plate **760**. Additionally, as best shown in FIG. **79**, the second plate **760** extends across the midfoot region **710** and the heel region **712**. Thus, the second plate **760** is only positioned below the sole plate **736** across a portion of the sole plate **736**, and more particularly, the arch or midfoot region thereof. In other embodiments, as previously discussed herein, the second plate **760** may extend across an entire length of the sole plate **736** or may be positioned at a location along the sole structure **704** where the sole plate **736** needs targeted structural support. The second plate **760** may be constructed from similar materials to the sole plate **736**, which have already be discussed herein. However, in particular embodiments, the material used to construct the second plate **760** may differ from the material used to construct the sole plate **736** such that the second plate **760** provides added reinforcement to the sole plate **736**. For example, in one embodiment, the sole plate **736** may be constructed from a carbon fiber material and the second plate **760** may be constructed from thermoplastic polyurethane (TPU) to support the sole plate **736**. Additionally, the second plate **760** may support the structural integrity of the sole plate **736** and prevent the sole plate **736** from fracturing during use thereof.

In addition to the second plate **760**, an amount of material may be injected into one or more grooves of the sole plate **736**. More particularly, in this embodiment, the sole plate **736** may include two grooves **762** formed from a plurality of raised portions **764** (see FIGS. **83**, **86**, and **87**), and material **766** may be injected or positioned within the grooves **762**. Similar to the second plate **760**, the material injected into the grooves **762** may provide further structural support to the sole plate **736** and targeted support to the sole plate **736**. For example, in this particular embodiment, the grooves are provided across the midfoot or arch region of the sole structure **704**, and therefore, the material **766** may provide support to the sole plate **736** in the arch region thereof, which thereby provides further support to a user's foot in the arch region of the sole structure **704**. The injected material **766** may be a suitable plastic material, such as thermoplastic polyurethane (TPU) or the like.

FIGS. **88** and **89** depict the second plate **760** of the present embodiment. Further, as discussed herein in connection with several embodiments, the second plates **560**, **660**, **760** may encase the sole plates **536**, **636**, **736**. To perform this function, the second plate **560**, **660**, **760** may include outer walls or sidewalls **570**, **670**, **770** that extend upward from the main body of the second plate **560**, **660**, **760**. Additionally, the second plate **560**, **660**, **760** may include a shape that conforms to the shape of the sole plate **536**, **636**, **736**. For example, as best shown in FIGS. **88** and **89**, the second plate **760** may include a plurality of raised portions **772** and grooves **774** that conform with the plurality of raised portions **764** and grooves **762** of the sole plate **736**.

EXAMPLES

The examples herein are intended to illustrate certain embodiments of the articles of footwear and sole structures discussed herein to one of ordinary skill in the art and should not be interpreted as limiting in the scope of the disclosure set forth in the claims. The articles of footwear and sole structures of the present disclosure may comprise the following non-limiting examples.

Example 1

Several studies were conducted to assess the performance of the sole structures discussed herein in comparison to other comparative sole structures. First, a mean relative maximum oxygen uptake for a subject wearing the sole structures **104**, **204**, **304** was measured and compared to the mean relative maximum oxygen uptake of the subject wearing comparative sole structures. These measurements were performed while the subject was running on a treadmill at various speeds, including 12 km/h, 14 km/h, and 16 km/h. The results of this study are shown in FIG. **90**.

Oxygen uptake or consumption is a measure of a person's ability to take in oxygen and deliver it to the working tissues of an athlete's body, but a lower mean relative maximum oxygen uptake equates to more efficient running. In other words, if a runner is more efficient by way of a more efficient and effective shoe sole, for example, the runner needs a lower amount of oxygen, and therefore, the runner would exhibit a lower mean relative maximum oxygen uptake. With reference to FIG. **90**, the sole structure **304** consistently had the lowest mean relative maximum oxygen uptake compared to other comparative soles across all speeds. However, at the higher speed of 16 km/h, the difference between the oxygen uptake values were accentuated and the article of footwear utilizing the sole structure **304** exhibited a mean relative maximum oxygen uptake of 49.1 ml/min/kg, which was far less than the other shoes having values greater than 51 ml/min/kg. The other sole structures **104**, **204** also exhibited very low oxygen uptake values in comparison to several of the comparative shoes. These results exhibit the improved efficiency the sole structures **104**, **204**, **304** can provide to a runner or athlete.

Example 2

Next, a mean heartrate of a subject wearing a shoe having the sole structures **104**, **204**, **304** was measured and compared to the heartrate of the subject wearing comparative sole structures. These measurements were performed while the subject was running on a treadmill at various speeds, including 12 km/h, 14 km/h, and 16 km/h.

The heartrate of a subject, like oxygen uptake, can be a measure of the efficiency of a runner and the efficiency of a sole structure worn by a runner. For example, if a runner is more efficient by way of a more efficient and effective sole structure, for example, the runner would have a lower mean heartrate. With reference to FIG. **91**, a runner wearing each sole structure **104**, **204**, **304** had a lower heartrate compared to several comparative shoe soles, which exhibits the improved efficiency imparted on a runner wearing a shoe having the sole structures **104**, **204**, **304**.

Example 3

The perceived exertion of the subjects was also documented after a subject ran on a treadmill at several speeds, including 12 km/h, 14 km/h, and 16 km/h. More particularly, a subject was asked to run at a speed of 12 km/h, for example, and then asked to provide a rating of perceived exertion from a zero to ten scale with zero indicating no perceived level of exertion and ten indicating a very high level of perceived exertion by the subject. These values were documented for articles of footwear having the sole structures **104**, **204**, **304**, compared with several comparative shoe soles, and then graphed. The results of this experiment are shown in FIG. **92**, and as shown in FIG. **92**, runners or subjects consistently provided low ratings for articles of footwear having the sole structures **104**, **204**, **304**. In particular, subjects consistently provided the lowest mean rating of perceived exertion for the sole structure **304** compared to the other sole structures, which shows the beneficial experience subjects or runners have with the sole structure **304** during use thereof.

Example 4

The mean lactate concentration for a subject wearing the sole structures **104**, **204**, **304** was also measured and compared to the lactate concentration of a subject or runner wearing articles of footwear with comparable sole structures. These measurements were performed while the subject was running on a treadmill at various speeds, including 12 km/h, 14 km/h, and 16 km/h. The results of this study are shown in FIG. **93**.

Blood lactate levels can serve as an indirect marker for biochemical events, such as fatigue within exercising muscle. Further, the concentration of blood lactate is usually 1-2 mmol/L at rest, but can rise to greater than 20 mmol/L during intense exertion. In short, the higher lactate concentration within the blood is an indication of fatigue for a runner. Therefore, lower lactate concentrations are desired because lower lactate concentrations indicate more efficient running and a more efficient sole structure that provides a higher level of performance to a runner. With reference to FIG. **93**, each sole structure **104**, **204**, **304** performed exceptionally compared to other sole structures and provided low lactate concentrates compared to the other tested sole structures. As previously discussed herein, higher speeds (such as 16 km/h) can provide clearer data and more accentuated differences between the sole structures, and

looking to the data collected at a running speed of 16 km/h, the sole structures **104**, **204**, **304** each registered lactate concentrations of about 3.2 mmol/l, which were significantly lower than the other comparable sole structures. As should be understood by one of ordinary skill in the art, these differences in lactate concentration (or decrease in lactate formation) can have a drastic and positive impact on runners during training, recovery, and performance activities, especially athletes or runners in endurance sports (e.g., marathon runners).

Example 5

In addition to measuring a lactate concentration of a subject or runner, a regression analysis rating of feeling and lactate concentration was performed. More particularly, for each sole structure, the subject or runner provided a perceived level of exhaustion using a zero to ten scale, with zero indicating no perceived level of exhaustion and ten indicating a very high level of exhaustion. Then these values were graphed with the lactate concentrations collected from Example 4 previously discussed herein. Specifically, for each speed and for each sole structure, the perceived levels of exhaustion for a runner were placed on a y-axis and their lactate concentrations were placed on the x-axis. This graph is shown in FIG. **94** and a regression analysis was performed to determine the statistical link between blood lactate concentration levels and perceived levels of exhaustion. After performing the regression analysis, the graph of FIG. **94** had an R-squared value of 0.92, thereby showing a strong statistical link between how tired runners felt and their lactate concentration in their blood.

Any of the embodiments described herein may be modified to include any of the structures or methodologies disclosed in connection with different embodiments. Further, the present disclosure is not limited to articles of footwear of the type specifically shown. Still further, aspects of the articles of footwear of any of the embodiments disclosed herein may be modified to work with any type of footwear, apparel, or other athletic equipment.

As noted previously, it will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

INDUSTRIAL APPLICABILITY

Numerous modifications to the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the invention. The exclusive rights to all modifications which come within the scope of the appended claims are reserved.

We claim:

1. A sole structure for an article of footwear having an upper, the sole structure comprising:

a first cushioning member disposed in a heel region of the sole structure;

a second cushioning member disposed in a forefoot region of the sole structure and spaced apart from the first cushioning member by a gap that extends between the first cushioning member and the second cushioning member; and

a sole plate that extends across the gap between the first cushioning member and the second cushioning member,

wherein at least one of:

the sole plate is positioned between the first cushioning member and the upper; and

the second cushioning member is positioned between the sole plate and the upper.

2. The sole structure of claim **1**, wherein the sole plate includes a rear portion and a curved portion, the curved portion including:

an anterior curved portion disposed proximate the second cushioning member, and

a posterior portion that spans the gap between the first cushioning member and the second cushioning member.

3. The sole structure of claim **2**, wherein the rear portion is disposed within the heel region and includes a planar portion.

4. The sole structure of claim **2**, wherein the curved portion is coupled to the second cushioning member and the rear portion is coupled to at least one of the first cushioning member and the upper.

5. The sole structure of claim **1**, wherein, in the heel region, the first cushioning member includes a longitudinal groove that segments the first cushioning member into a first flex zone and a second flex zone.

6. The sole structure of claim **5** further comprising an outsole that includes a first outsole portion secured to the first flex zone and a second outsole portion secured to the second flex zone.

7. The sole structure of claim **1** further comprising an outsole defining a ground engaging surface that is discontinuous in a midfoot region, wherein at least one of:

the first cushioning member is positioned between the sole plate and the outsole in the heel region, and

the second cushioning member is positioned between the sole plate and the outsole in the forefoot region.

8. The sole structure of claim **1**, wherein the first cushioning member extends from the heel region into a midfoot region and the second cushioning member extends from the forefoot region into the midfoot region.

9. The sole structure of claim **8**, wherein a front end of the first cushioning member extends from the heel region toward and past a rear end of the second cushioning member in the midfoot region such that the front end of the first cushioning member is closer to the forefoot region than is the rear end of the second cushioning member.

10. The sole structure of claim **9**, wherein the front end of the first cushioning member is positioned above the rear end of the second cushioning member.

11. The sole structure of claim **1**, wherein at least one of the first cushioning member and the second cushioning member is a supercritical foam with pockets of gas therein, and

wherein the sole plate extends through the gap between the first cushioning member and the second cushioning member.

12. The sole structure of claim **1**, wherein at least one of:

the sole plate is positioned within at least one of the first cushioning member and the second cushioning member; and

the sole plate extends along a ground engaging surface in the forefoot region.

13. The sole structure of claim **1**, wherein the gap extends an entire width of the sole structure from a lateral side to a medial side thereof.

14. A sole structure for an article of footwear having an upper, the sole structure comprising:

a first cushioning member;

a second cushioning member that is spaced apart from the first cushioning member by a gap that extends between the first cushioning member and the second cushioning member; and

a sole plate that extends across the gap from the first cushioning member to the second cushioning member, the sole plate extending away from the upper moving across the gap from the first cushioning member to the second cushioning member,

wherein the sole plate is positioned within at least one of the first cushioning member and the second cushioning member.

15. The sole structure of claim **14**, wherein the first cushioning member is positioned in a heel region of the sole structure and the second cushioning member is positioned in a forefoot region of the sole structure.

16. The sole structure of claim **14**, wherein at least one of:

the sole plate is positioned between the first cushioning member and the upper, and

the second cushioning member is positioned between the sole plate and the upper.

17. The sole structure of claim **14**, wherein the sole plate includes:

a substantially planar rear portion coupled to the first cushioning member;

an anterior curved portion coupled to the second cushioning member; and

a posterior curved portion that spans the gap between the first cushioning member and the second cushioning member.

18. The sole structure of claim **14**, wherein the sole plate is coupled to the first cushioning member.

19. The sole structure of claim **14**, wherein the gap extends along a non-linear path that extends from a medial side of the sole structure to a lateral side of the sole structure.

20. The sole structure of claim **14**, wherein at least one of:

the sole plate is positioned between the first cushioning member and the upper;

the second cushioning member is positioned between the sole plate and the upper; and

the sole plate extends along a ground engaging surface and the second cushioning member.

21. The sole structure of claim **14**, wherein the gap extends an entire width of the sole structure from a lateral side to a medial side thereof.

22. An article of footwear, comprising:

an upper; and

a sole structure that extends between the upper and a ground surface, the sole structure defining a ground engaging surface and including:

an outsole, and

a sole plate positioned between the upper and the outsole, the sole plate including a rear portion in a heel region, an anterior curved portion extending along the ground engaging surface in a forefoot region, and a posterior curved portion extending away from the upper between the rear portion and the anterior curved portion.

23. The article of footwear of claim **20** further comprising a first cushioning member and a second cushioning member.

24. The article of footwear of claim **23**, wherein the first cushioning member and the second cushioning member are spaced apart from one another by a gap that extends an entire width of the sole structure between the first cushioning member and the second cushioning member from a lateral side to a medial side.

25. The article of footwear of claim **21**, wherein the first cushioning member is positioned between the sole plate and the outsole and the second cushioning member is positioned between the sole plate and the upper.

26. The article of footwear of claim **23**, wherein the rear portion is configured as a substantially planar portion and is secured to at least one of the upper and the first cushioning member.

27. The article of footwear of claim **23**, wherein the first cushioning member defines a U-shaped end and the sole plate extends into the U-shaped end.

28. The article of footwear of claim **23**, wherein each of the first cushioning member and the second cushioning member are positioned between the sole plate and the outsole.

29. The article of footwear of claim **23**, wherein the sole plate bifurcates at least one of the first cushioning member and the second cushioning member.

30. The article of footwear of claim **23**, wherein at least one of:

the sole plate is positioned between the first cushioning member and the upper;

the second cushioning member is positioned between the sole plate and the upper; and

the sole plate is positioned within at least one of the first cushioning member and the second cushioning member.

31. The article of footwear of claim **23**, wherein a front end of the first cushioning member is closer to a forefoot region than is a rear end of the second cushioning member, and

wherein the front end of the first cushioning member is positioned above the rear end of the second cushioning member.

32. A sole structure for an article of footwear having an upper, the sole structure comprising:

a first cushioning member disposed in a heel region of the sole structure;

a second cushioning member disposed in a forefoot region of the sole structure, the second cushioning member being spaced apart from the first cushioning member in a midfoot region of the sole structure by a gap that extends between the first cushioning member and the second cushioning member from a lateral side of the sole structure to a medial side of the sole structure; and

a sole plate including a rear portion in the heel region, an anterior curved portion extending along a ground engaging surface in the forefoot region, and a posterior curved portion extending between the rear portion and the anterior curved portion, the sole plate extending away from the upper as the sole plate extends between the first cushioning member and the second cushioning member,

wherein at least one of:

the sole plate is positioned within at least one of the first cushioning member and the second cushioning member;

the sole plate is positioned between the first cushioning member and the upper; and

the second cushioning member is positioned between the sole plate and the upper.

33. The sole structure of claim **32**, wherein the gap extends an entire width of the sole structure from the lateral side to the medial side thereof.

* * * * *

EXHIBIT B

US011974629B2

(12) **United States Patent**
Redon et al.

(10) **Patent No.: US 11,974,629 B2**
(45) **Date of Patent: *May 7, 2024**

(54) **ARTICLE OF FOOTWEAR HAVING A SOLE PLATE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

(72) Inventors: **Arnaud Redon**, Nuremberg (DE); **Romain Girard**, Lauf an der Pegnitz (DE)

(73) Assignee: **PUMA SE**, Herzogenaurch (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **17/992,397**

(22) Filed: **Nov. 22, 2022**

(65) **Prior Publication Data**

US 2023/0078289 A1 Mar. 16, 2023

Related U.S. Application Data

(63) Continuation of application No. 17/404,388, filed on Aug. 17, 2021, now Pat. No. 11,622,602.

(60) Provisional application No. 63/067,073, filed on Aug. 18, 2020.

(51) **Int. Cl.**

A43B 13/18	(2006.01)
A43B 13/04	(2006.01)
A43B 13/14	(2006.01)

(52) **U.S. Cl.**
CPC ***A43B 13/186*** (2013.01); ***A43B 13/04*** (2013.01); ***A43B 13/141*** (2013.01); ***A43B 13/146*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,542,598	A *	9/1985	Misevich	A43B 13/16 36/31
6,625,905	B2 *	9/2003	Kita	A43B 13/12 36/28
6,634,121	B2 *	10/2003	Sordi	A43B 13/141 36/31
8,418,379	B2 *	4/2013	Nishiwaki	A43B 13/181 36/28
8,850,721	B2 *	10/2014	Long	A43B 7/22 36/107
10,226,099	B2 *	3/2019	Bischoff	B29D 35/122
11,089,834	B2 *	8/2021	Chambers	A43B 3/0057
2002/0078591	A1 *	6/2002	Morrone	A43B 5/12 36/102
2013/0059939	A1 *	3/2013	Sato	C08K 7/14 264/41
2018/0132564	A1 *	5/2018	Bruce	A43B 13/189
2019/0276650	A1 *	9/2019	Baghdadi	A43B 13/186
2020/0114634	A1 *	4/2020	Hensley	A43B 13/20

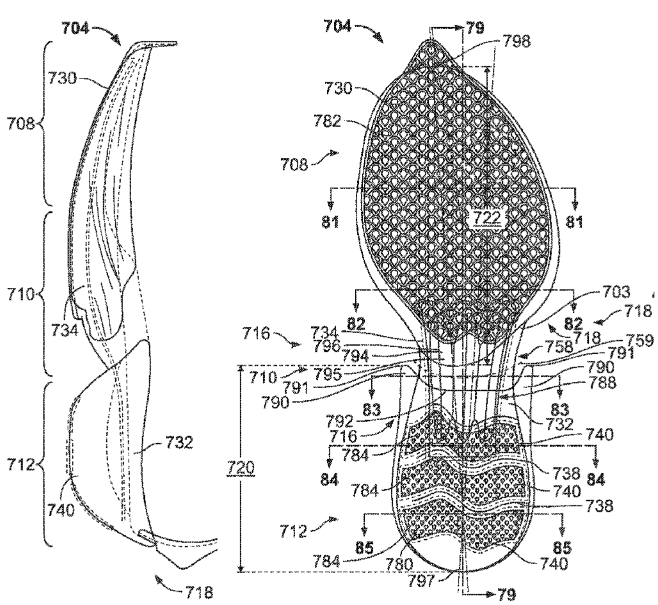
* cited by examiner

Primary Examiner — Jila M Mohandesi
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

(57) **ABSTRACT**

An article of footwear having a sole structure and an upper, the sole structure including a first cushioning member positioned in a heel region of the sole structure and a second cushioning member positioned in a forefoot region of the sole structure. A gap extends between the first cushioning member and the second cushioning member in a midfoot region of the sole structure, and one or both of the first cushioning member or the second cushioning member are a supercritical foam with pockets of nitrogen gas therein.

26 Claims, 41 Drawing Sheets



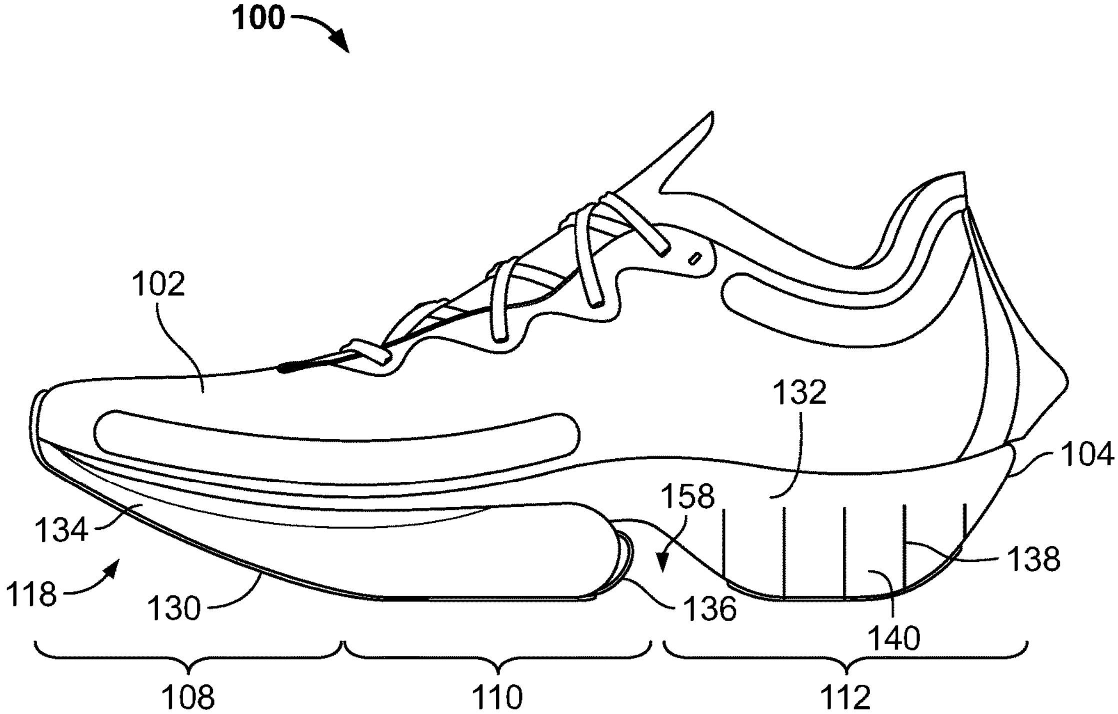


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FIG. 1

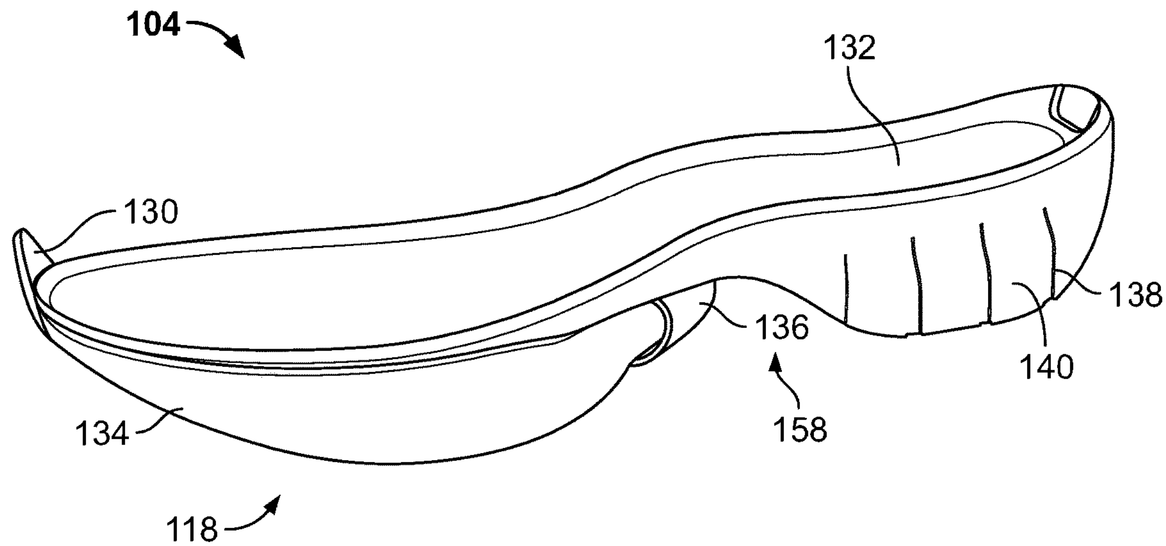

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FIG. 2

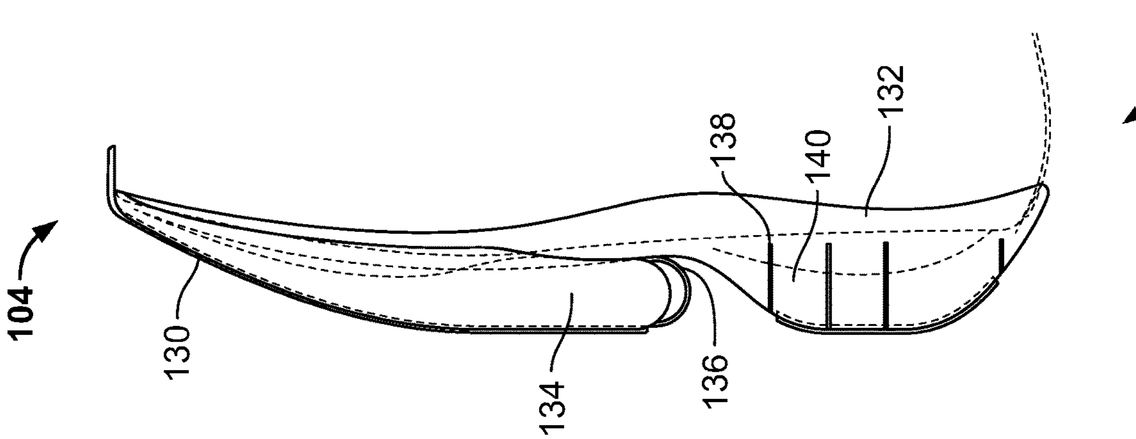
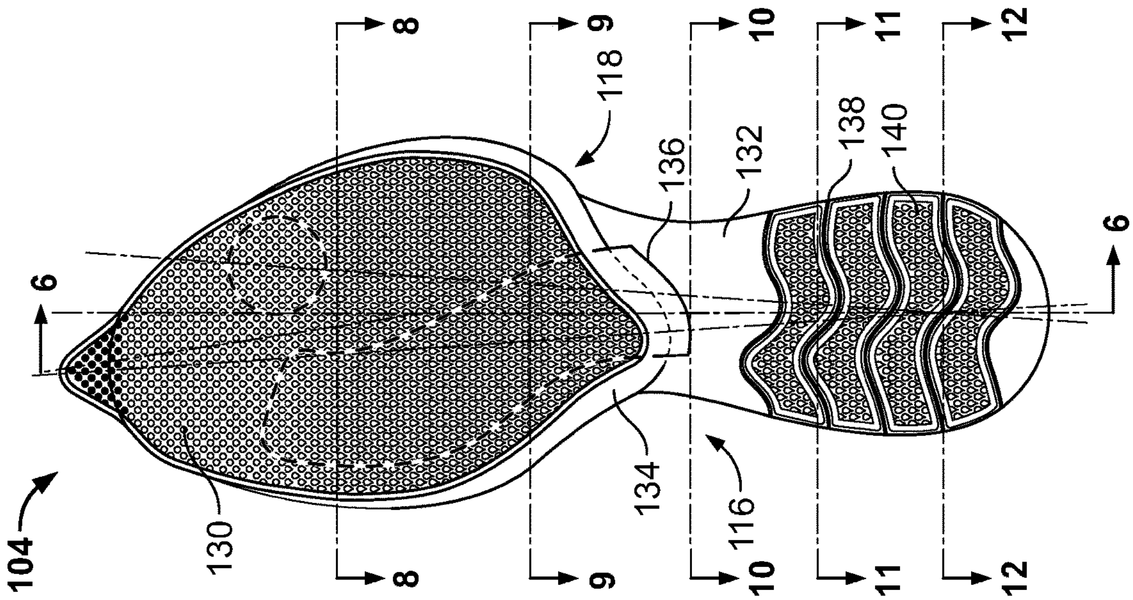


FIG. 3



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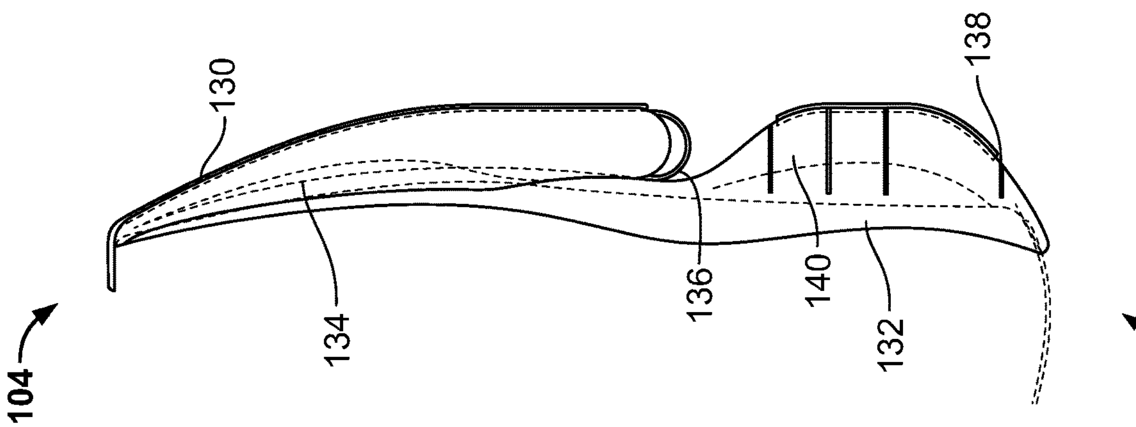

FIG. 5

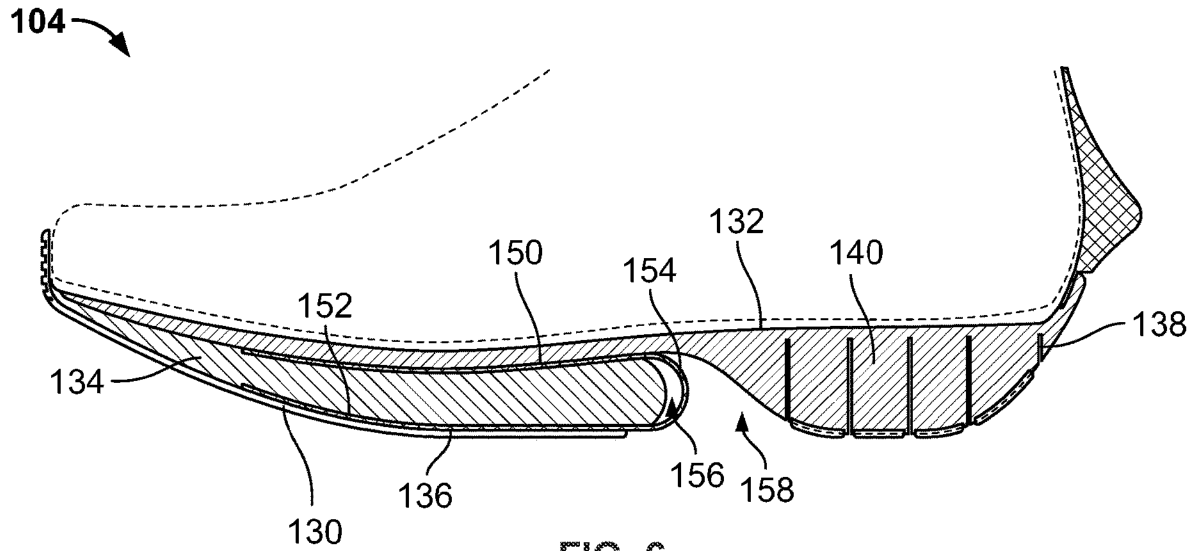

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FIG. 6

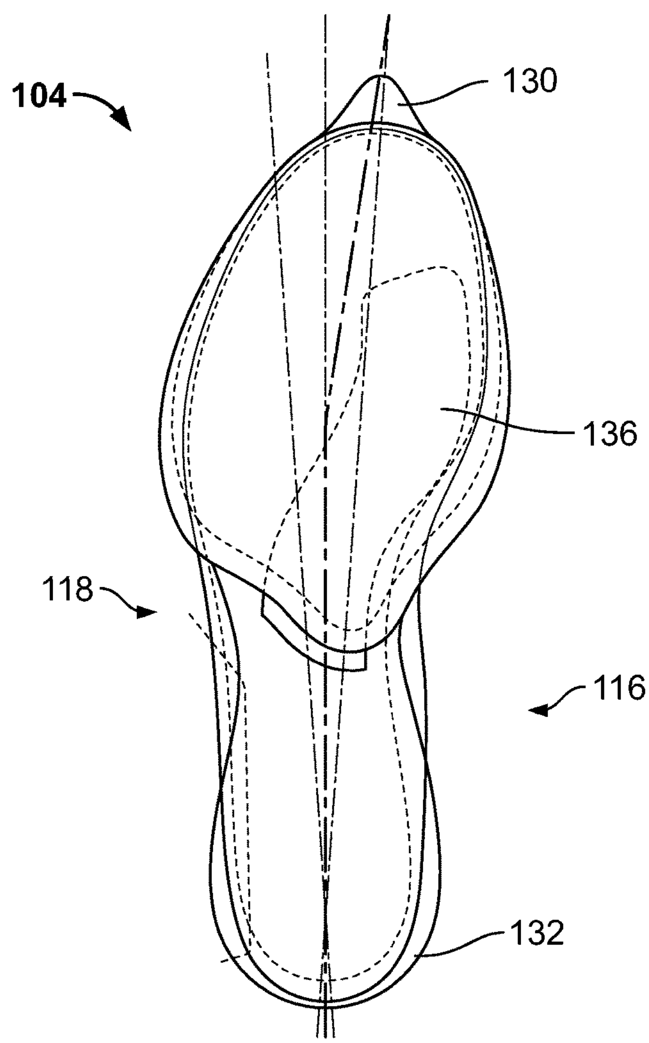

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FIG. 7

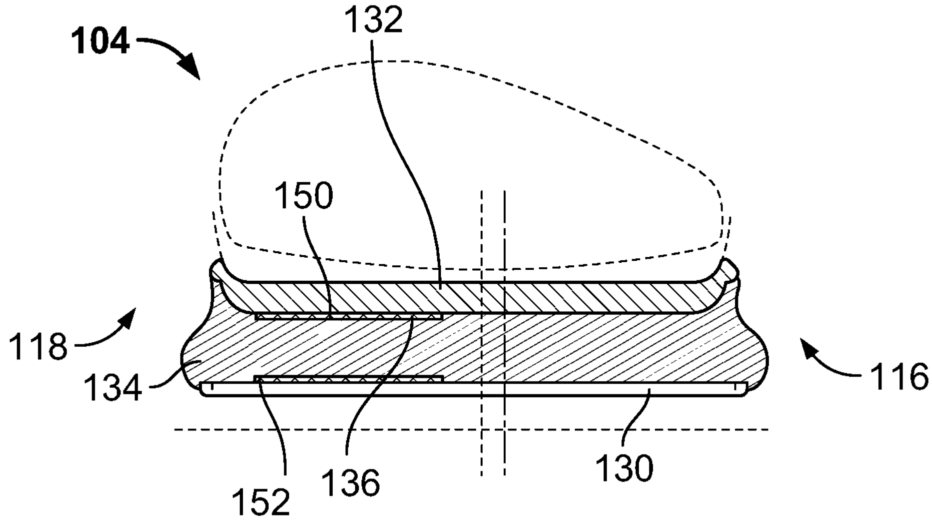

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FIG. 8

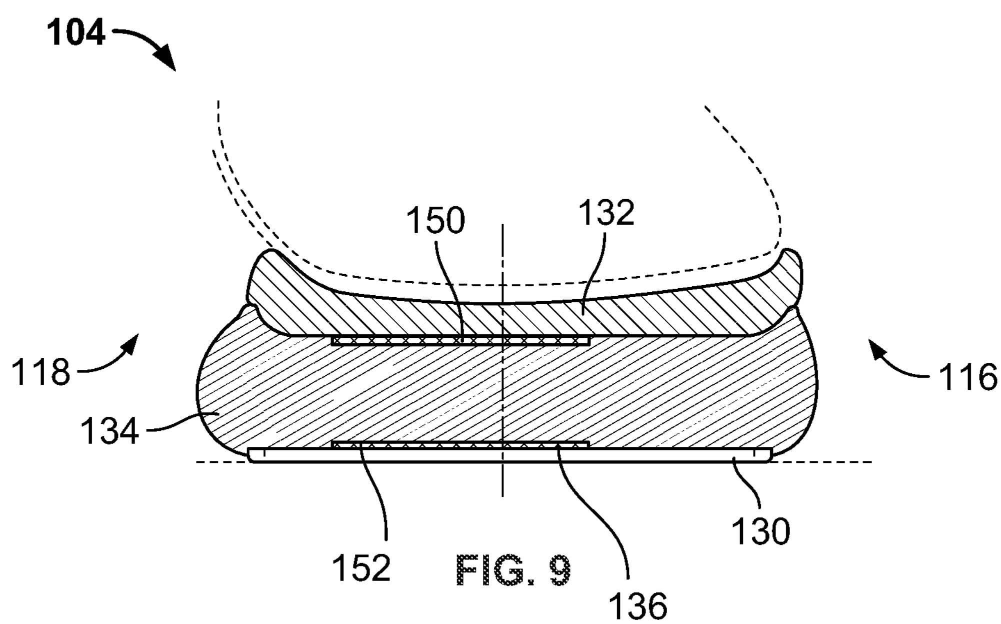

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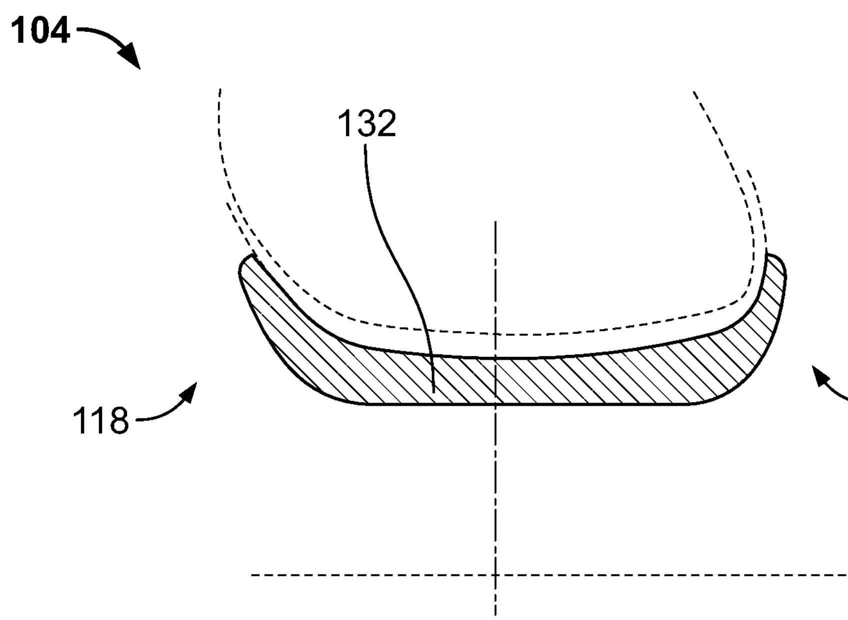
FIG. 9



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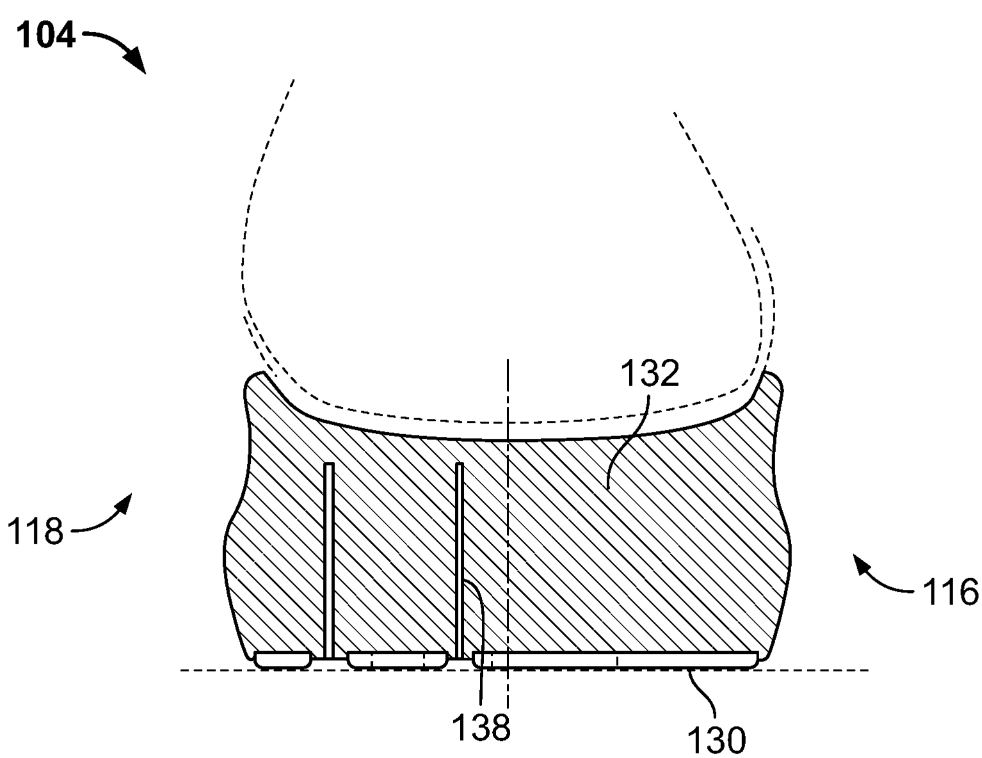

FIG. 11

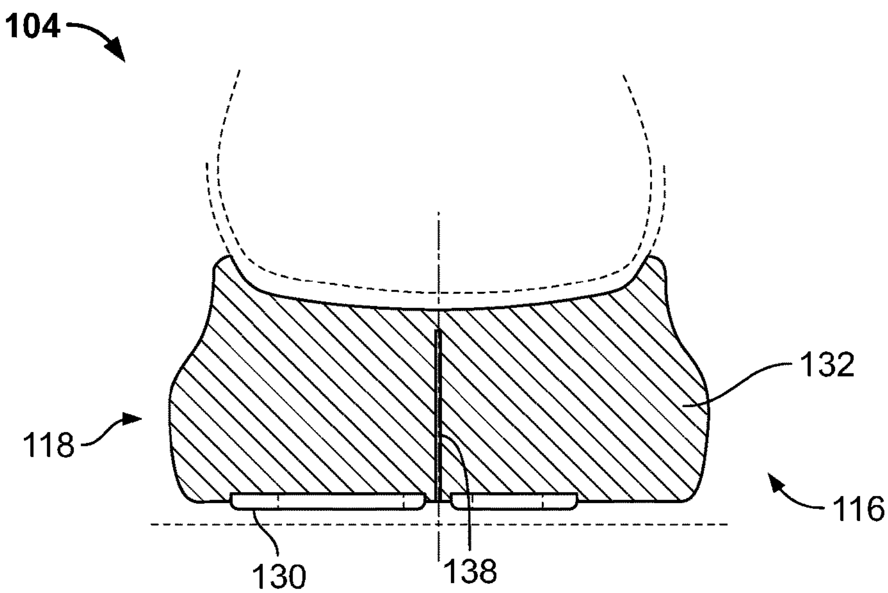

FIG. 12

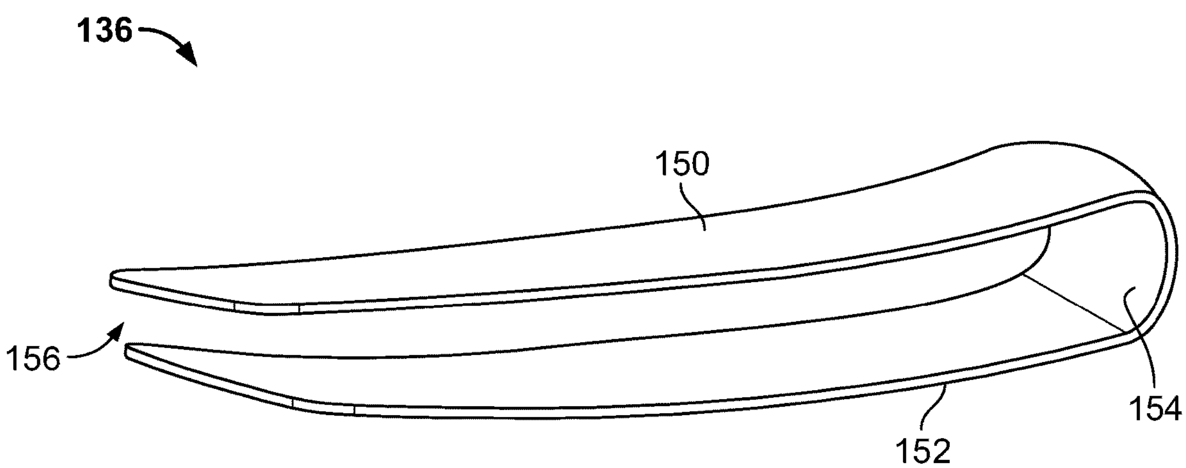

FIG. 13

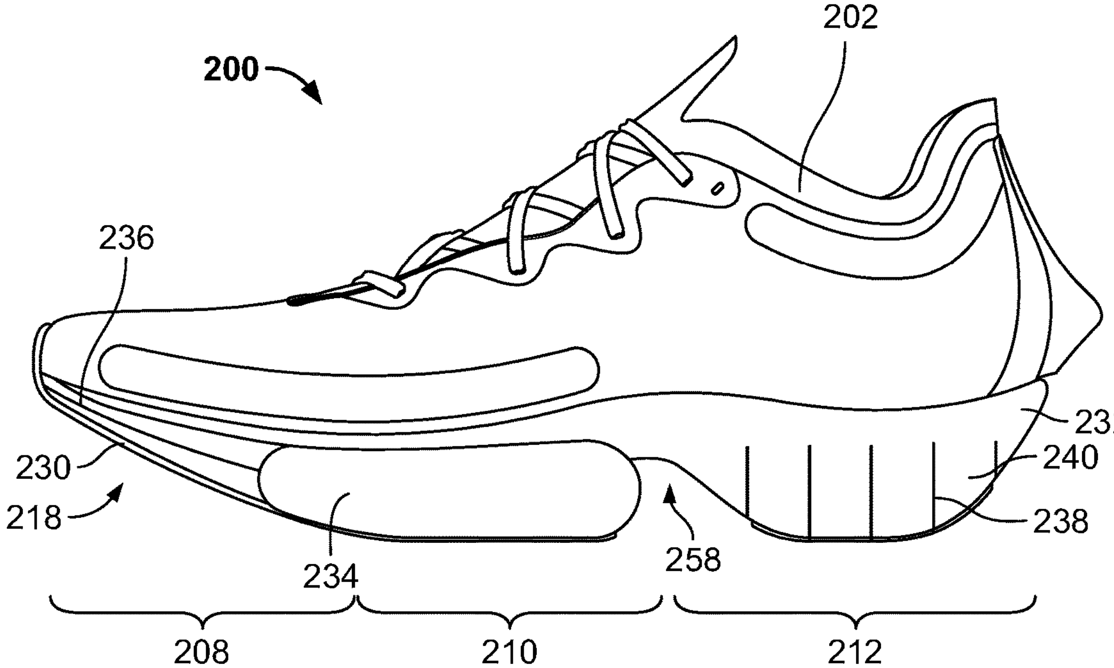

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FIG. 14

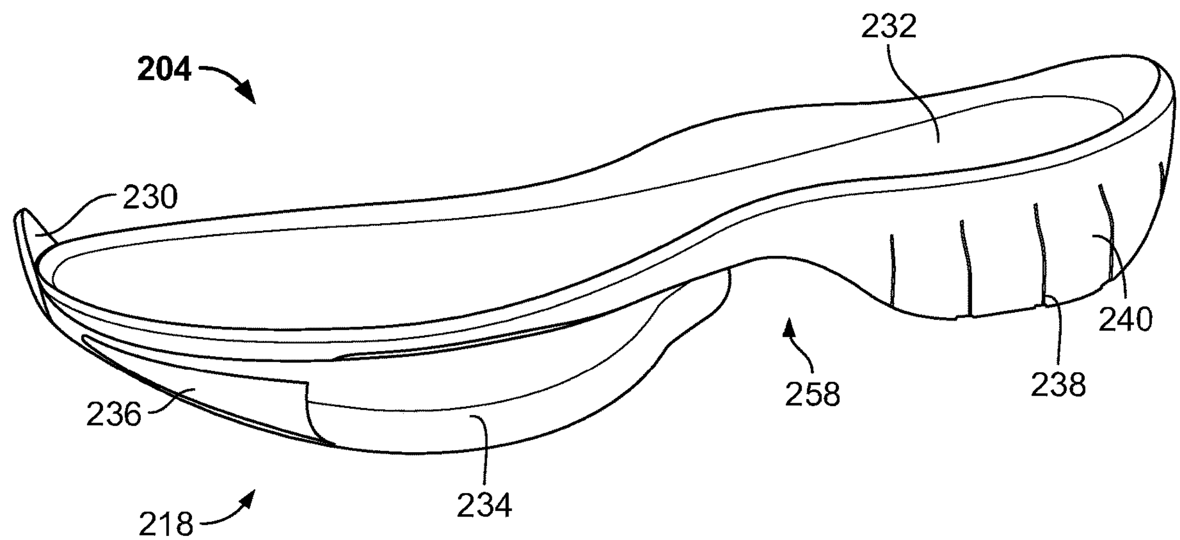

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FIG. 15

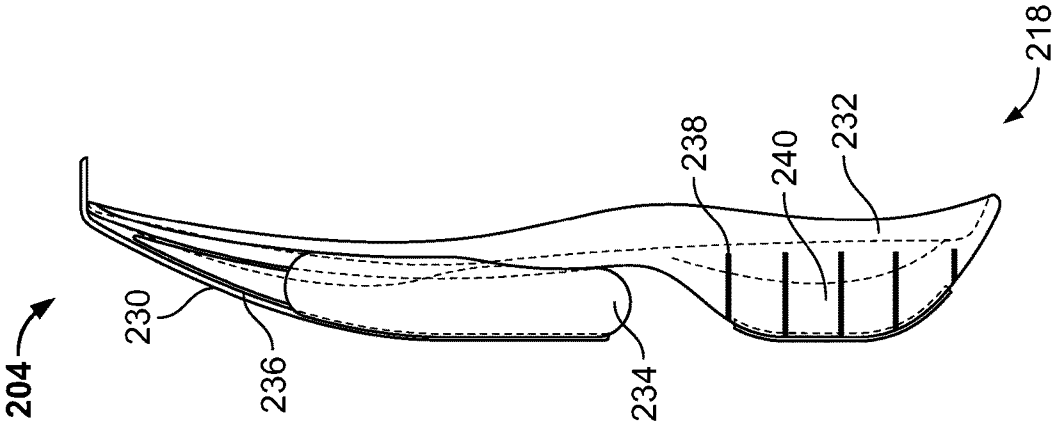

FIG. 16

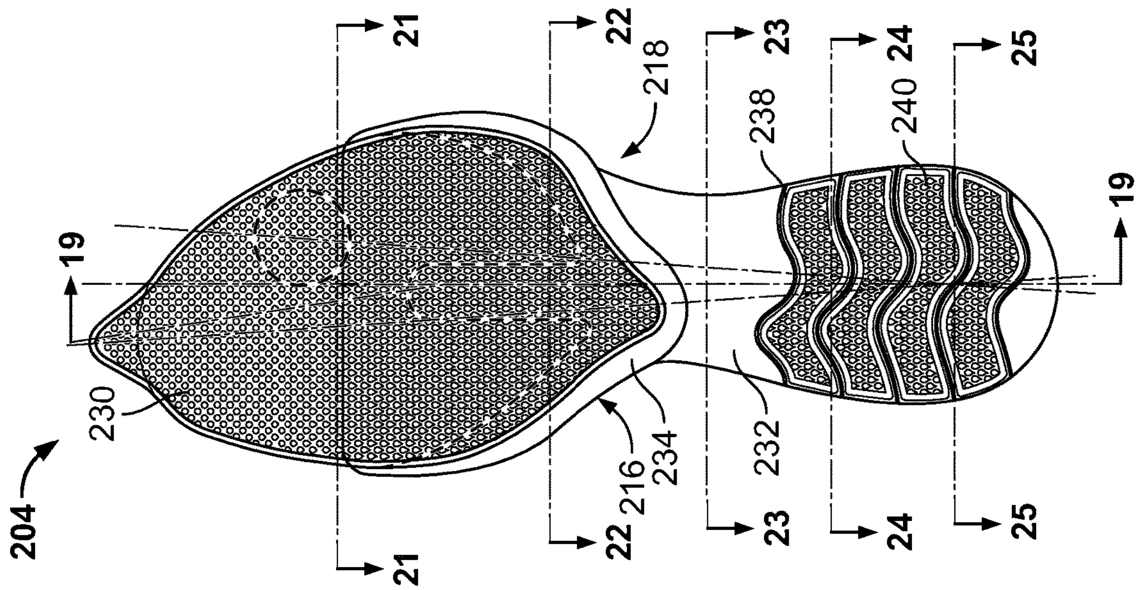

FIG. 17

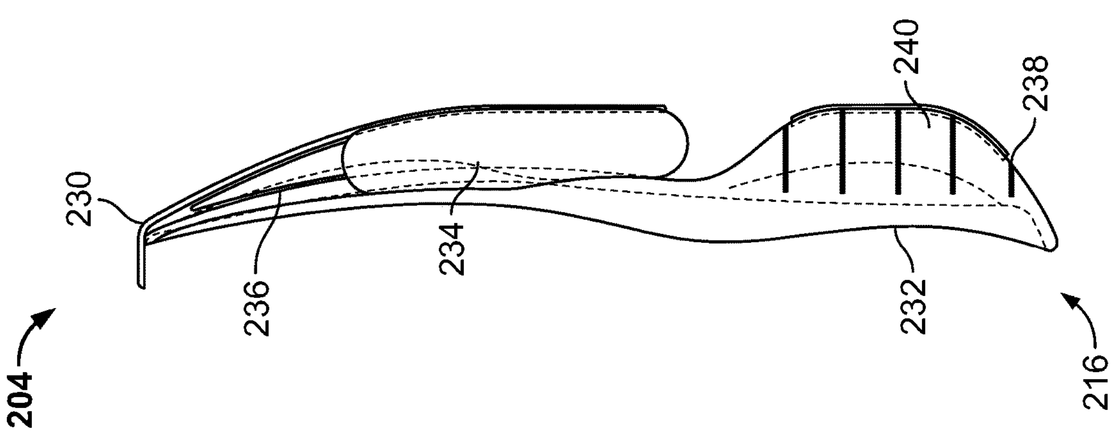

FIG. 18

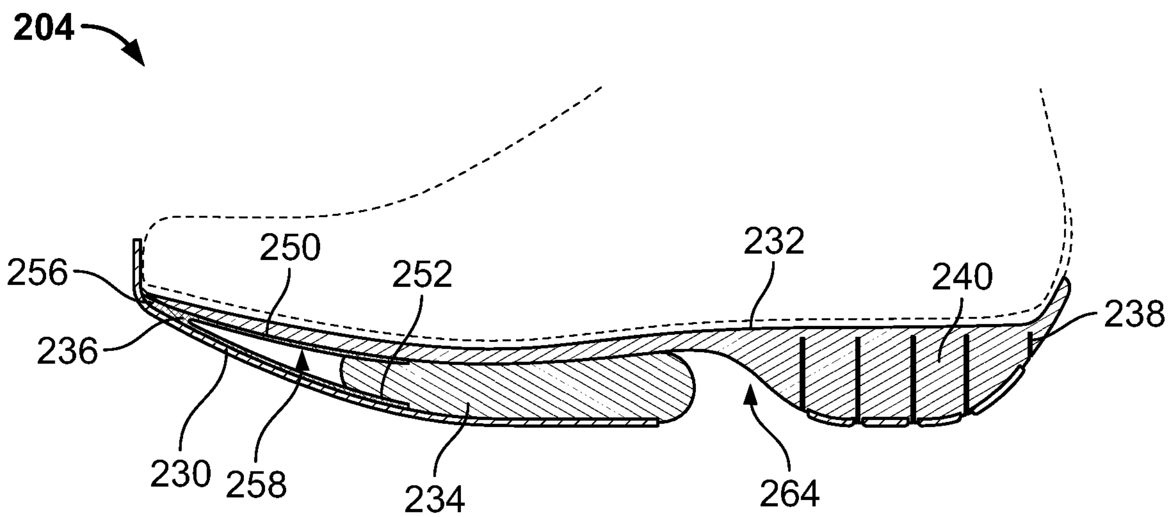

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FIG. 19

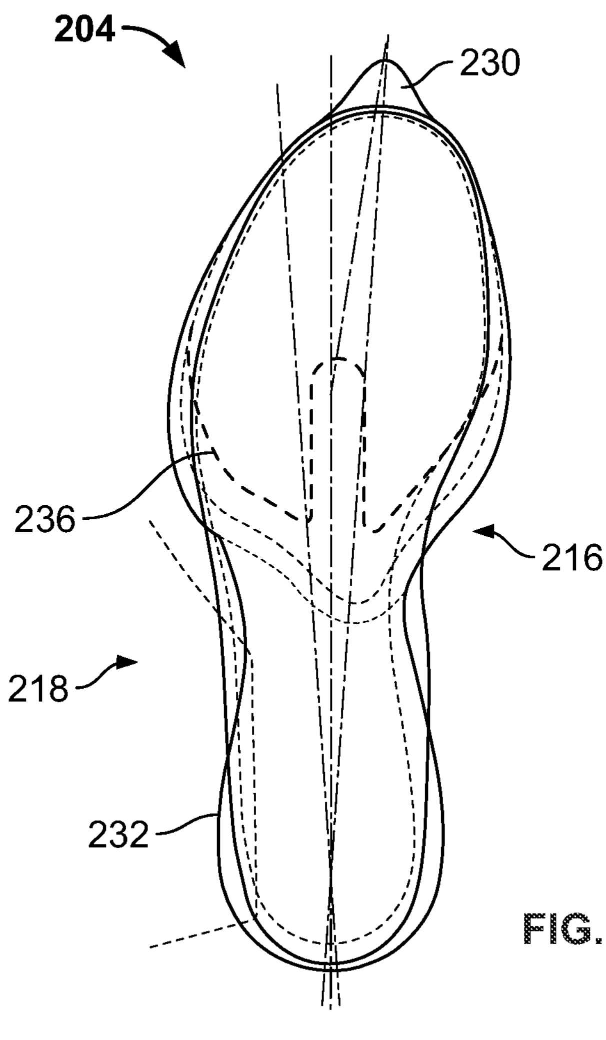

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FIG. 20

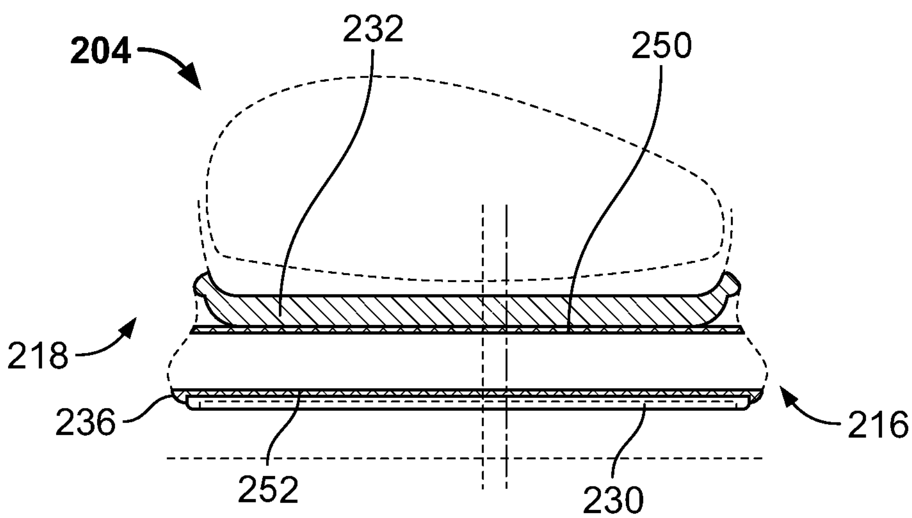

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FIG. 21

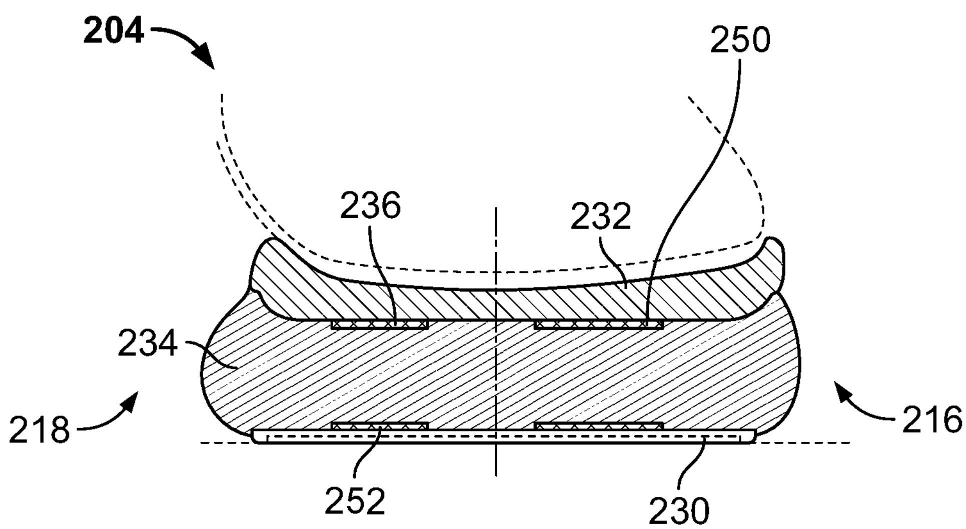

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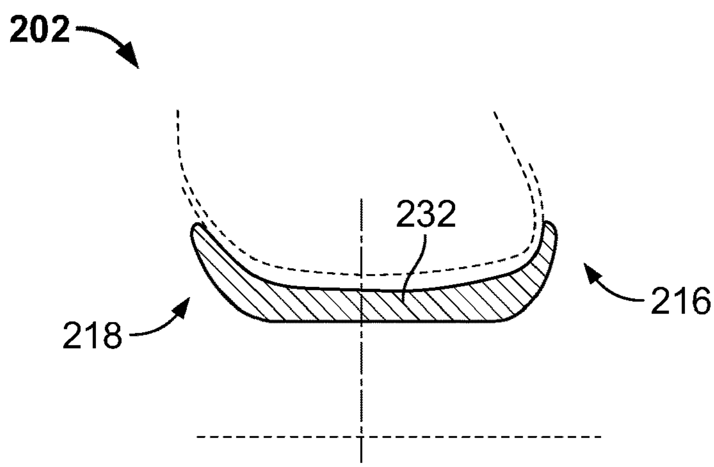
FIG. 22



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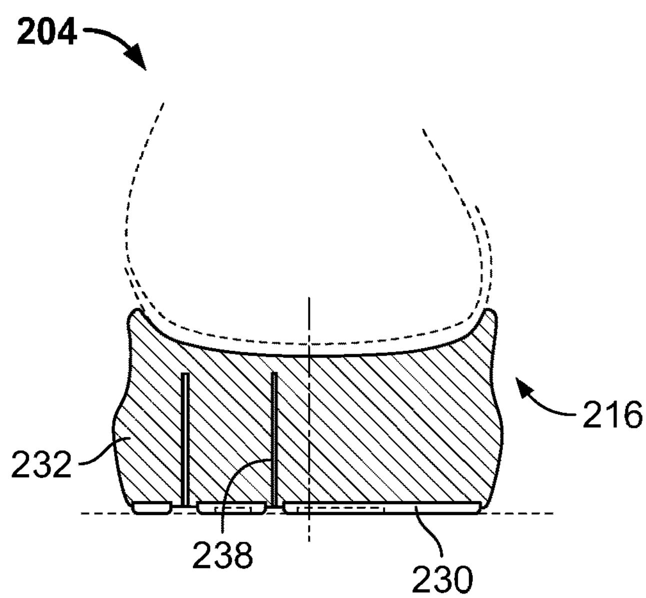
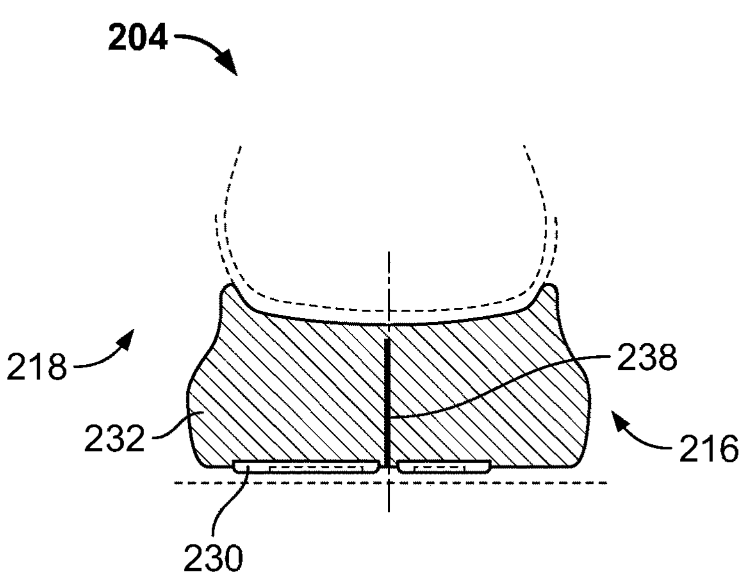


FIG. 24



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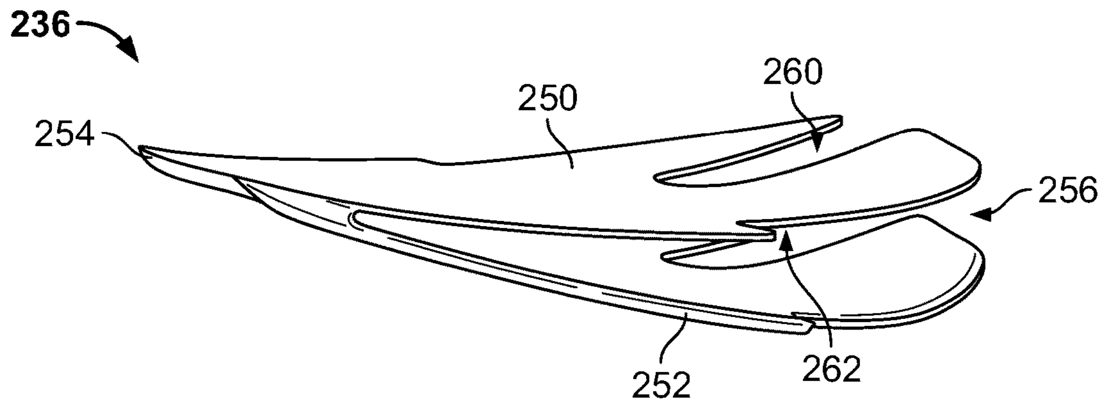

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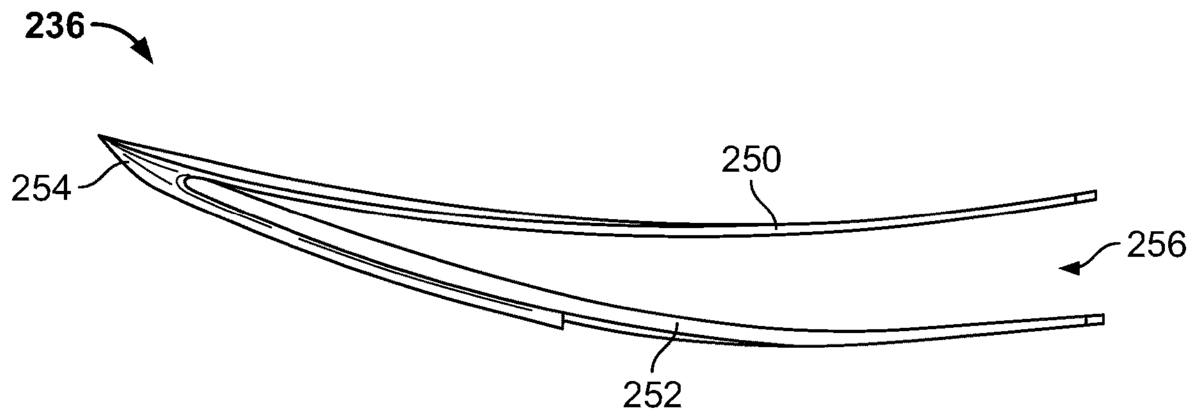
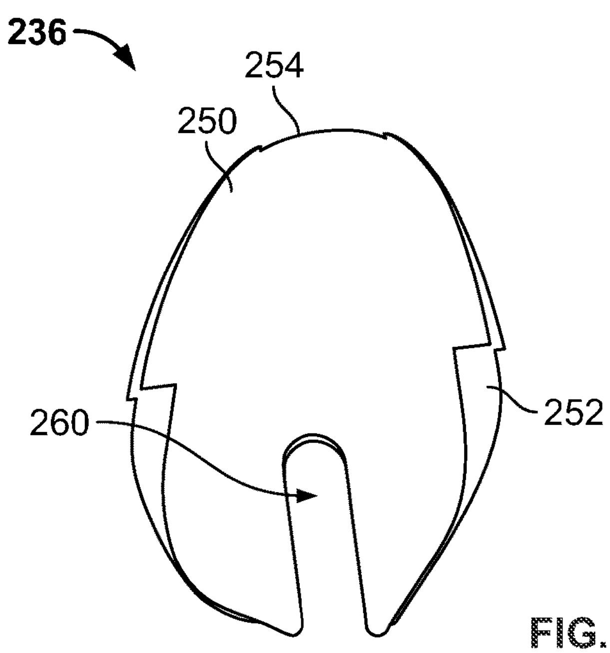


FIG. 27



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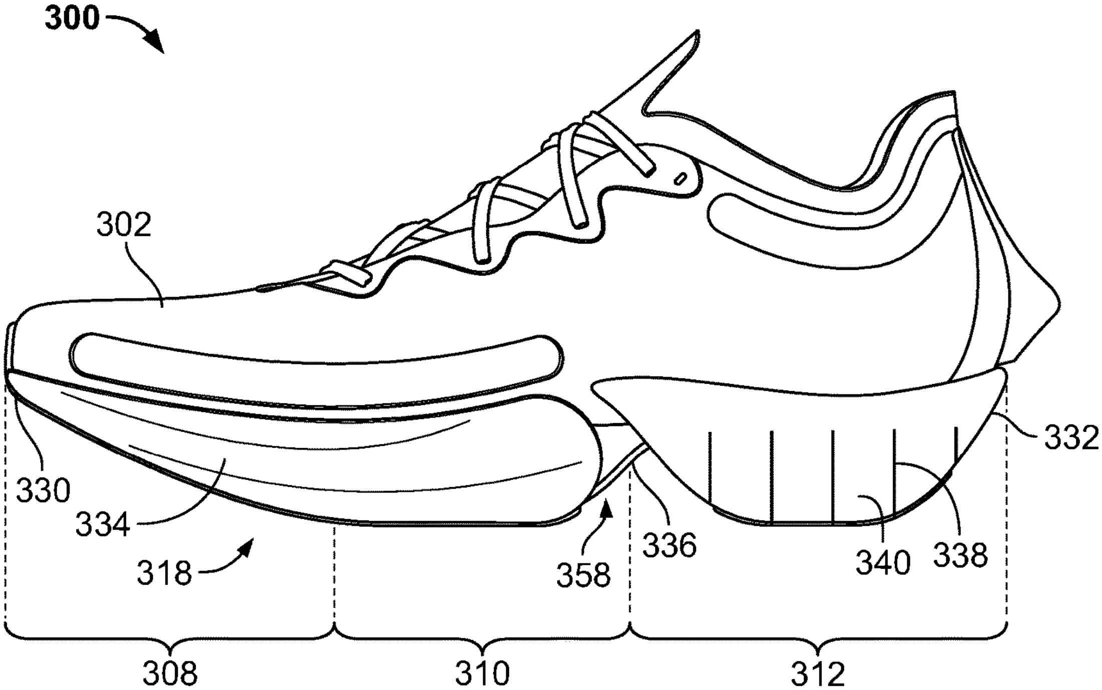
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FIG. 29

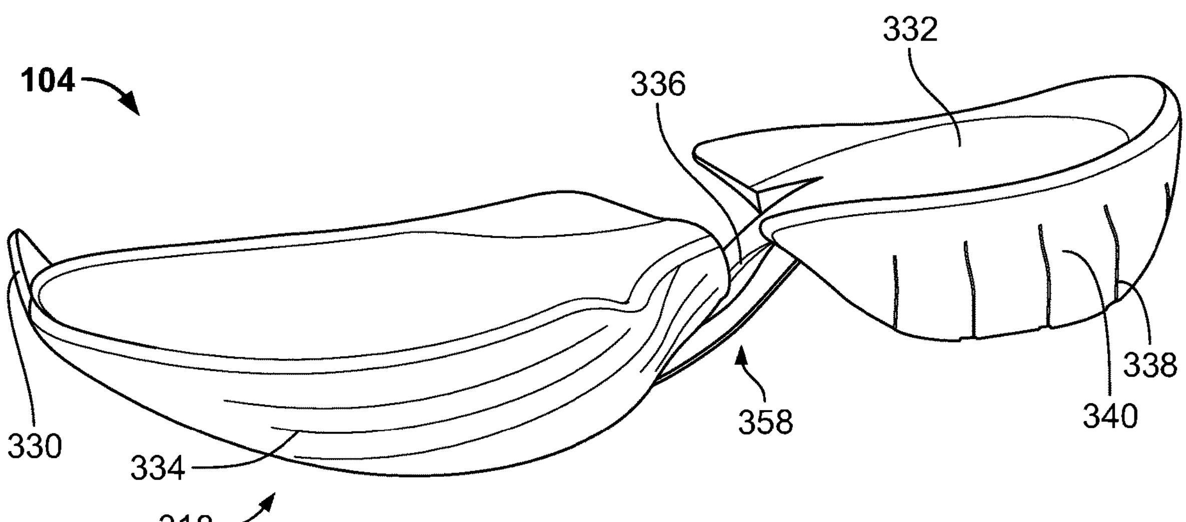
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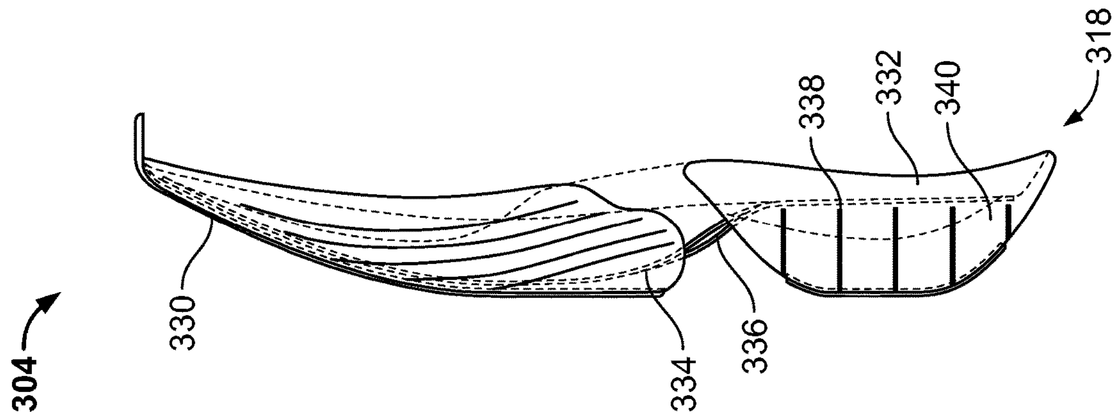
FIG. 30



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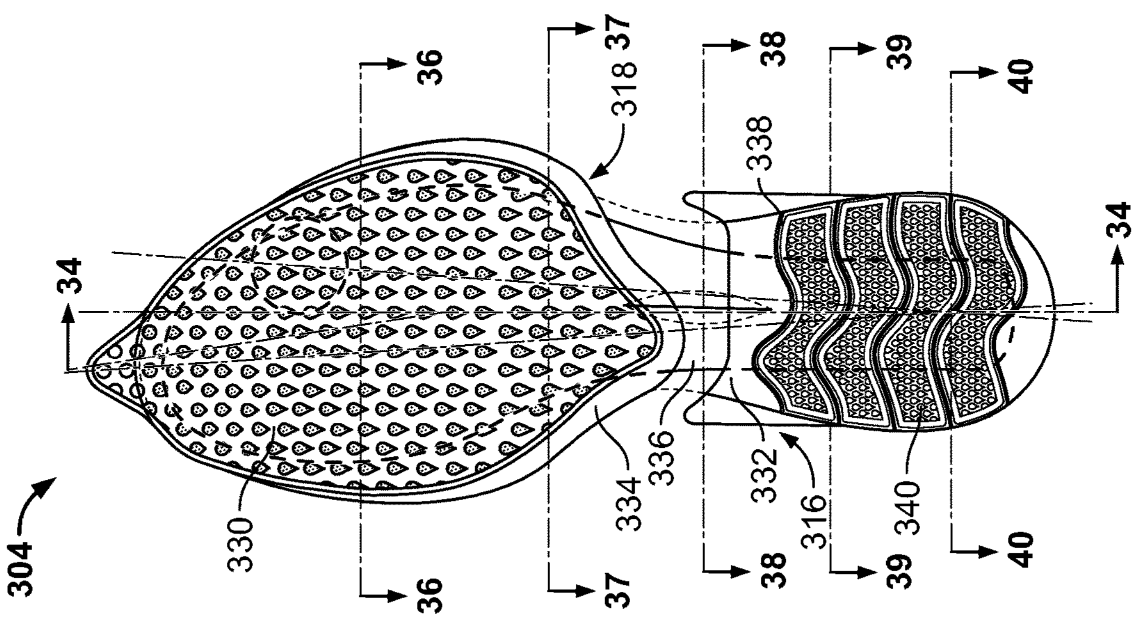

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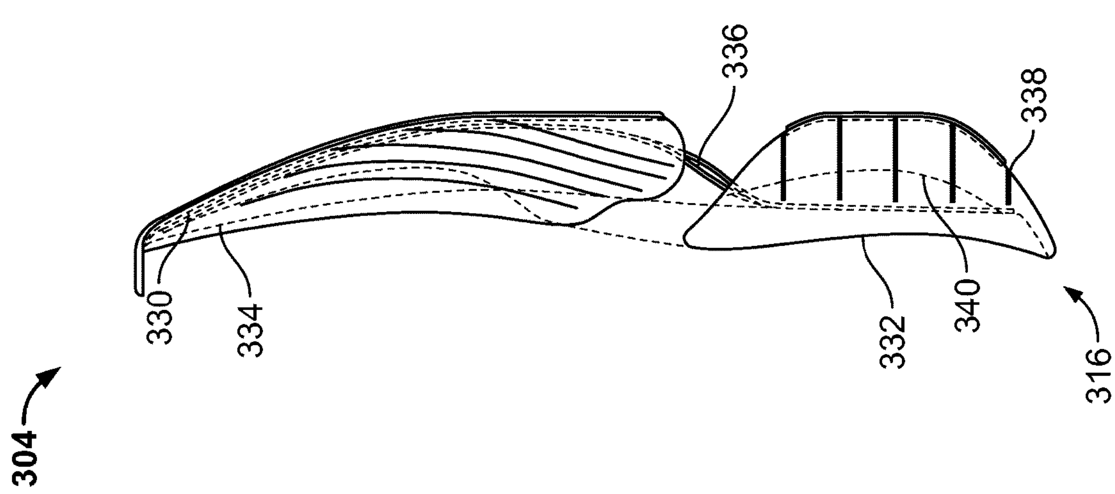


FIG. 33

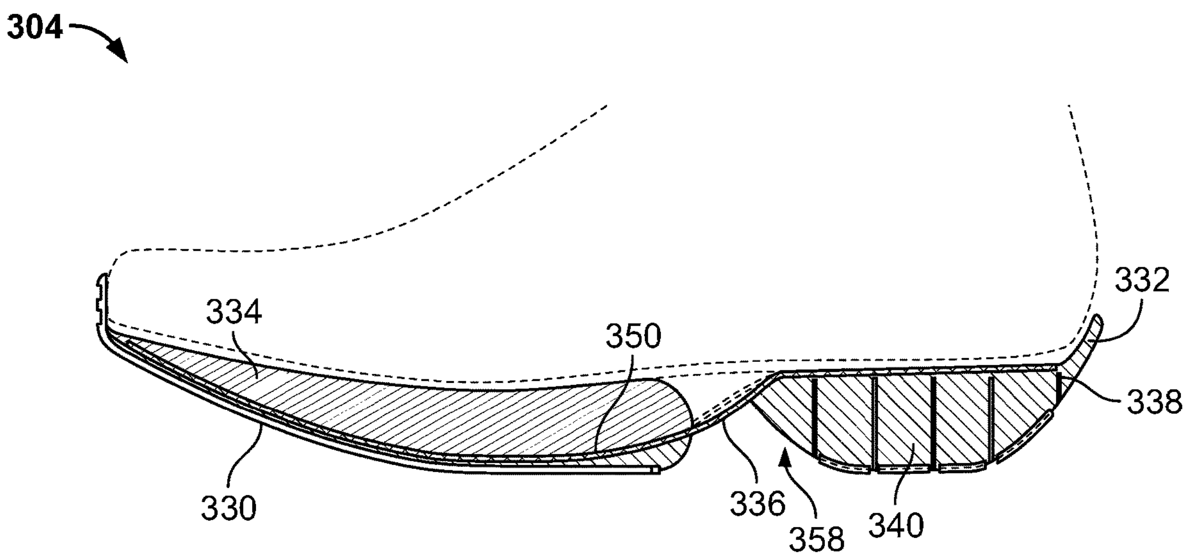


FIG. 34

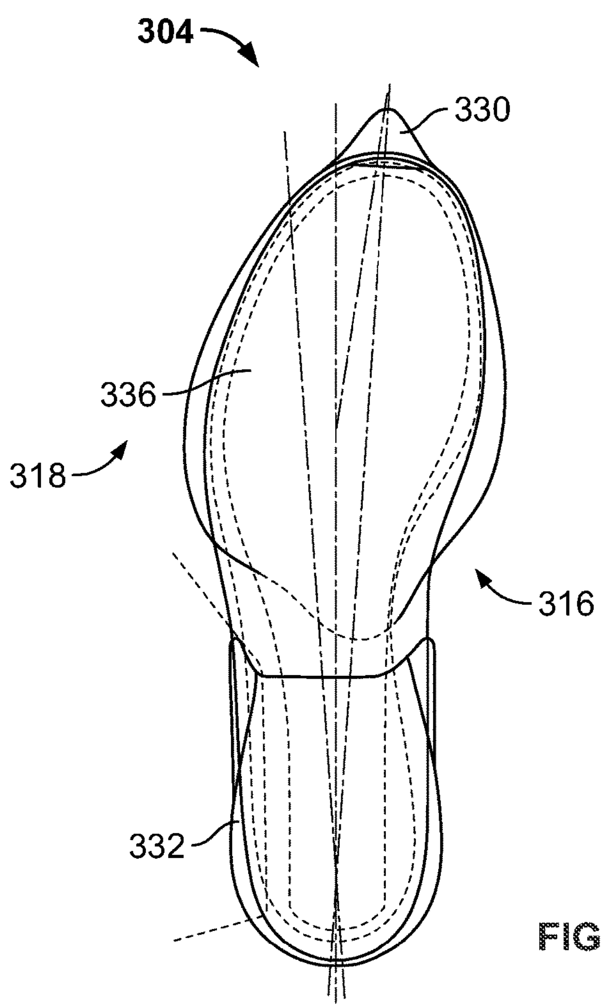


FIG. 35

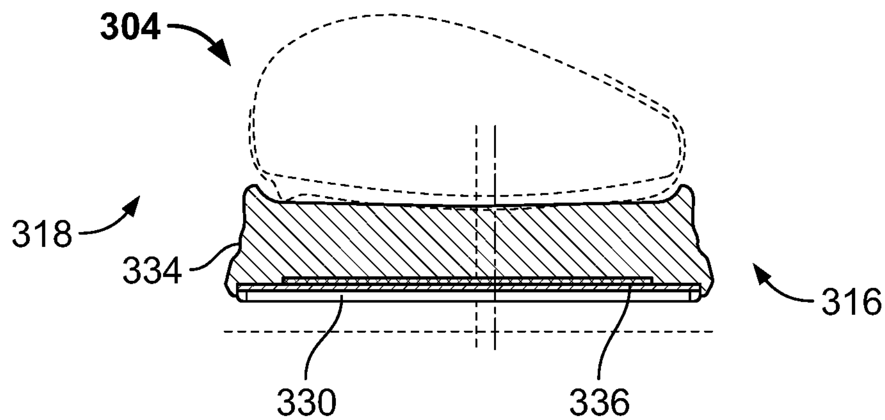


FIG. 36

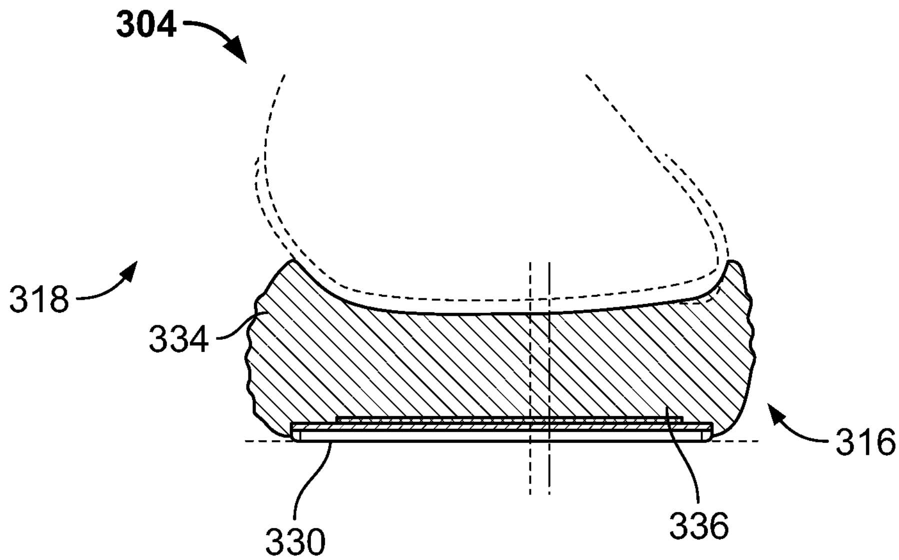


FIG. 37

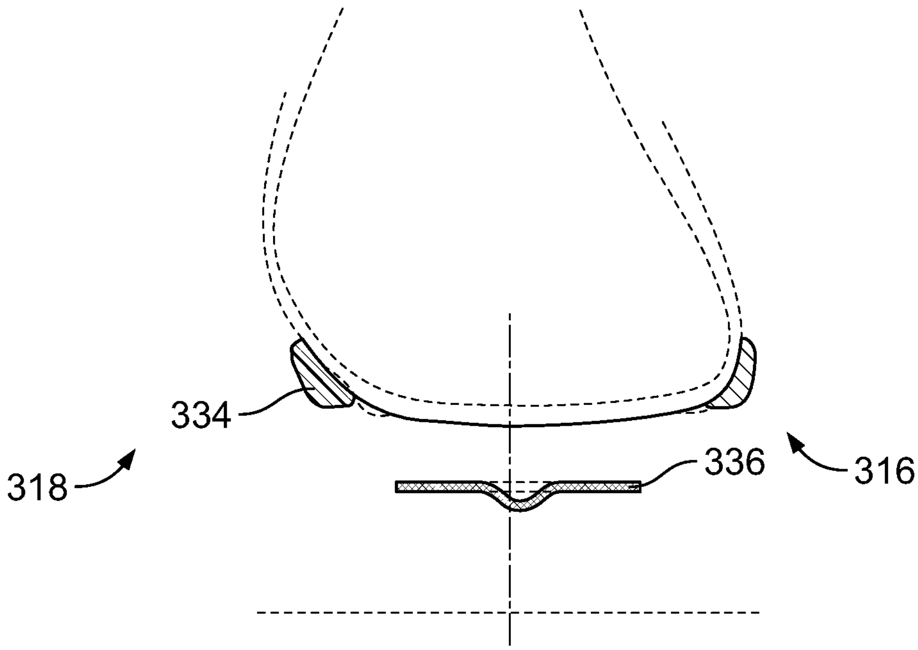


FIG. 38

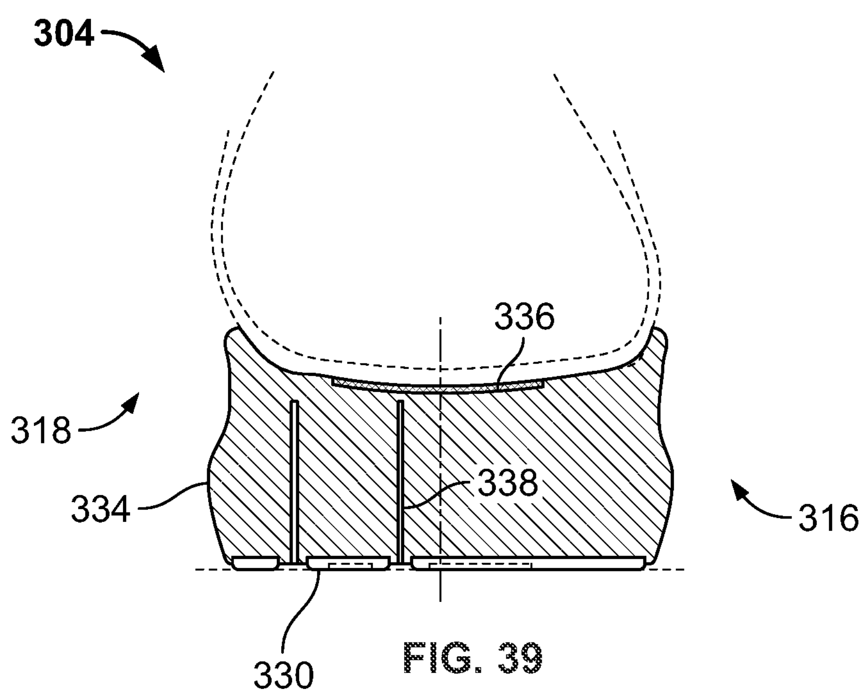
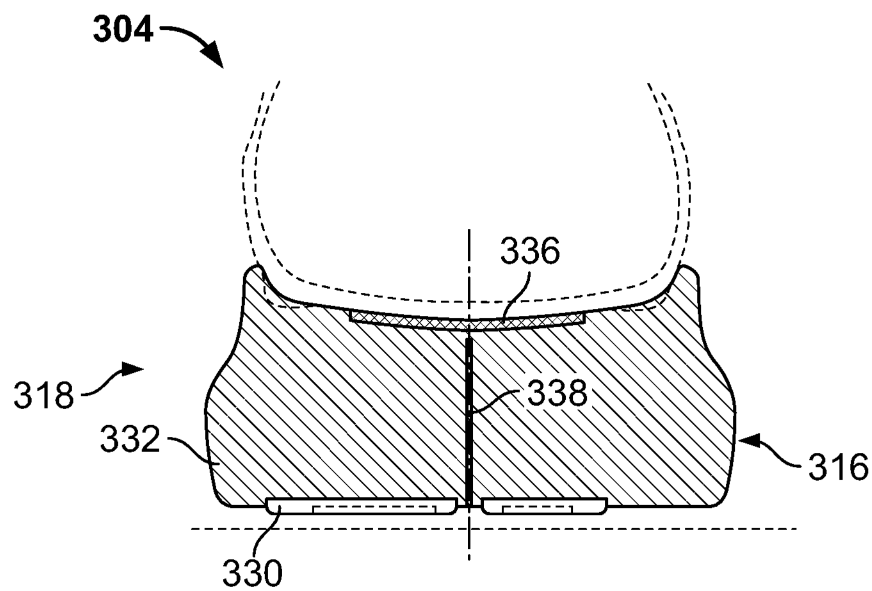


FIG. 39



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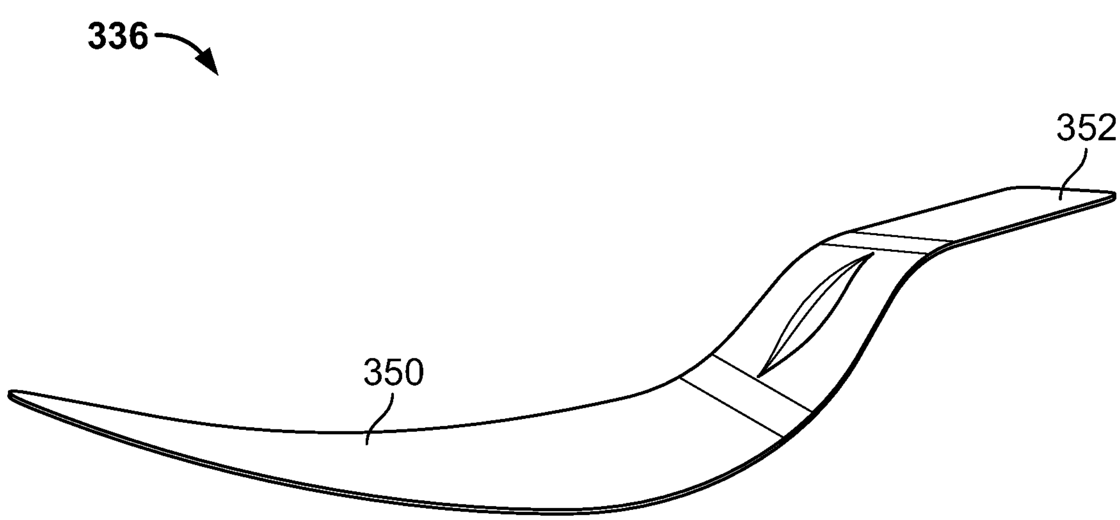

FIG. 41

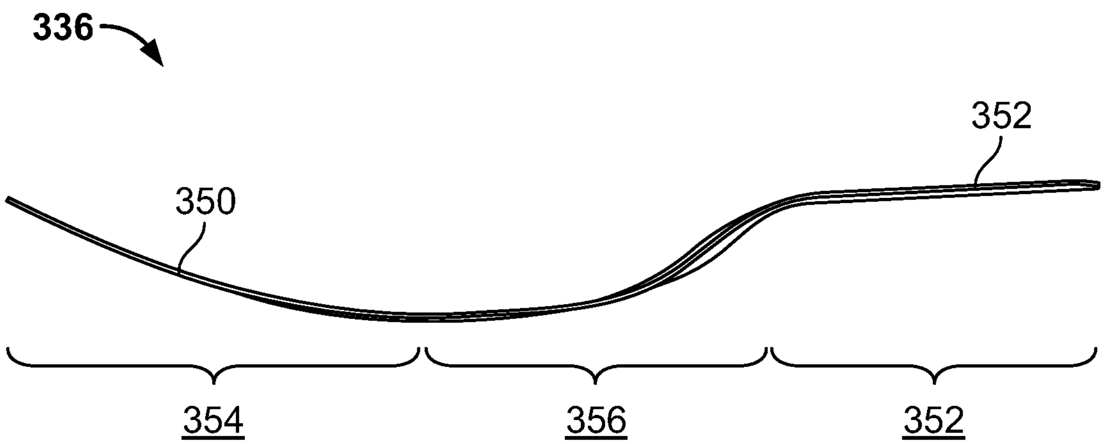

FIG. 42

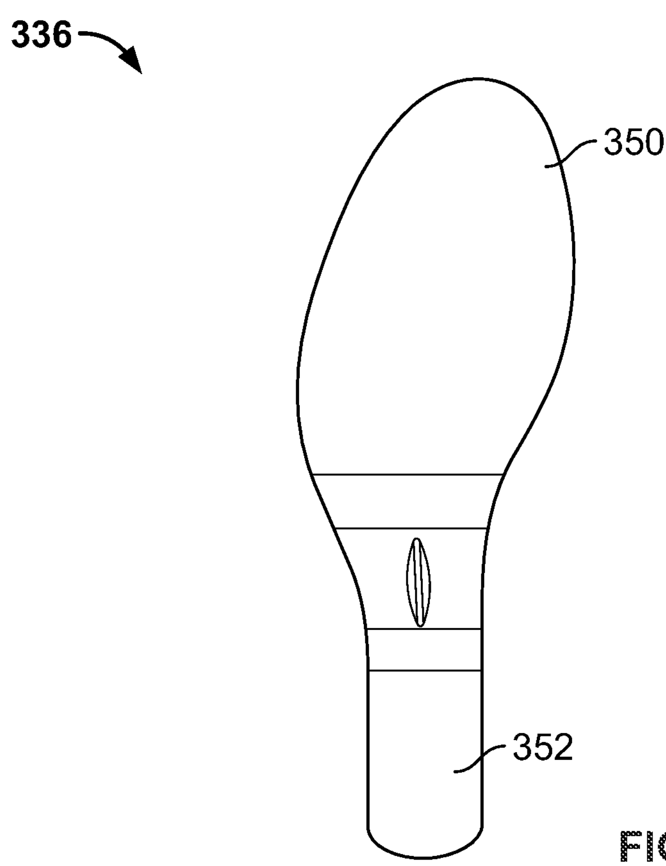

FIG. 43

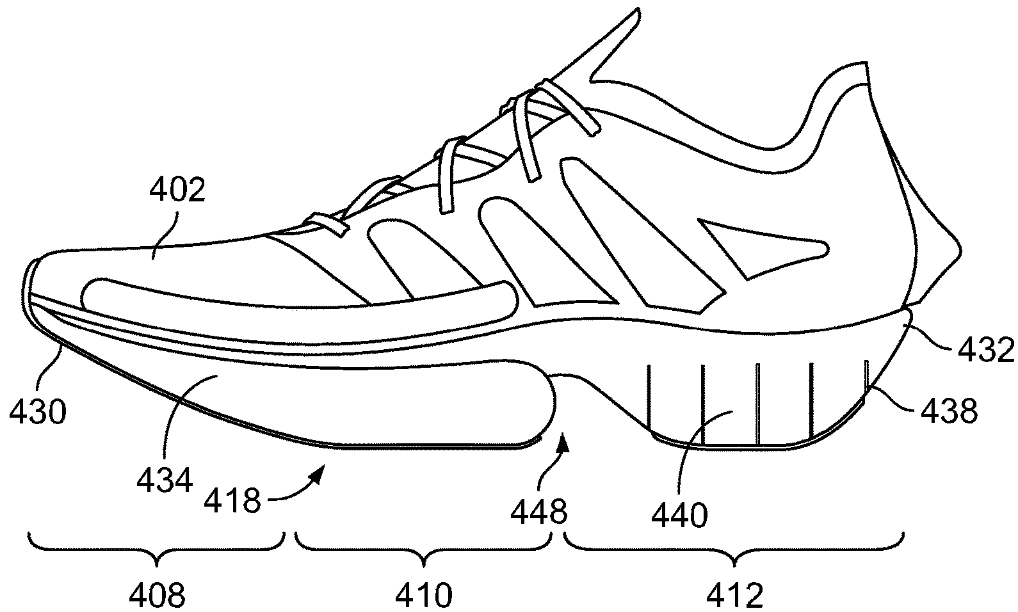
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FIG. 44

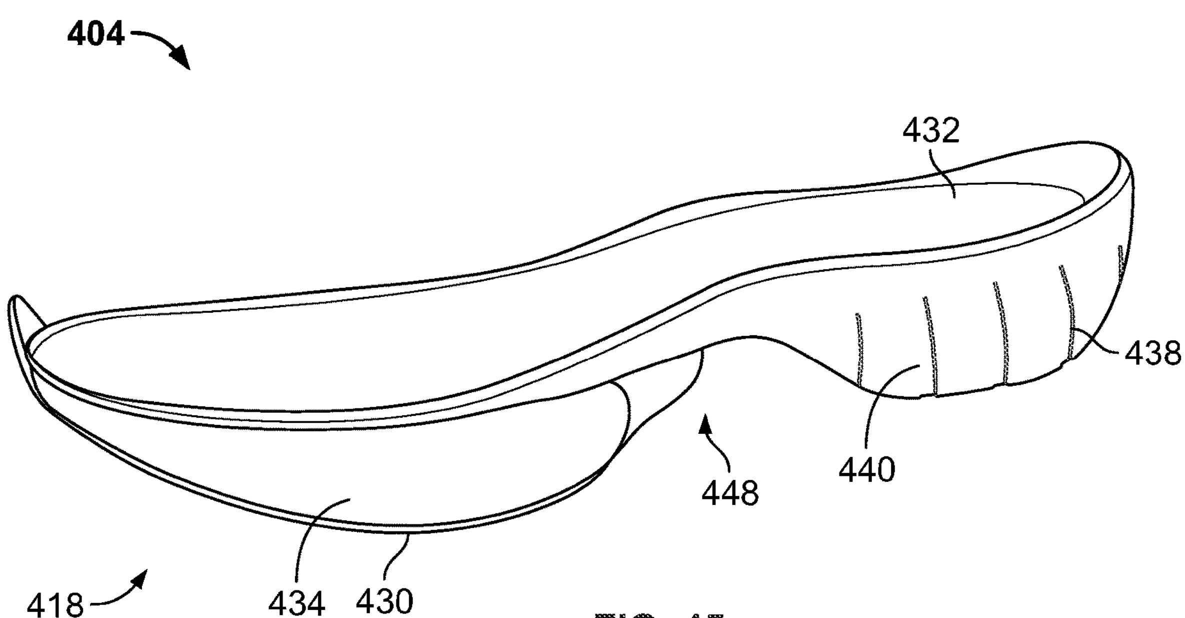
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FIG. 45

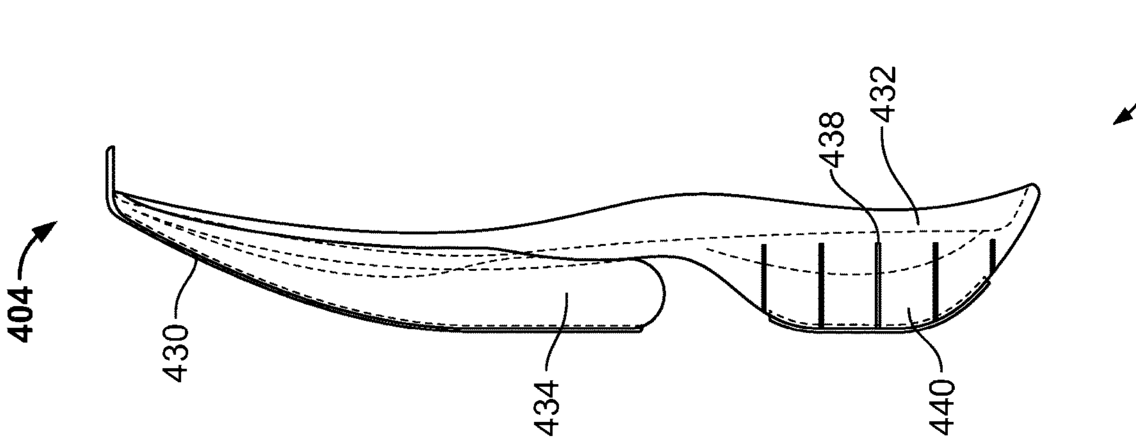


FIG. 46

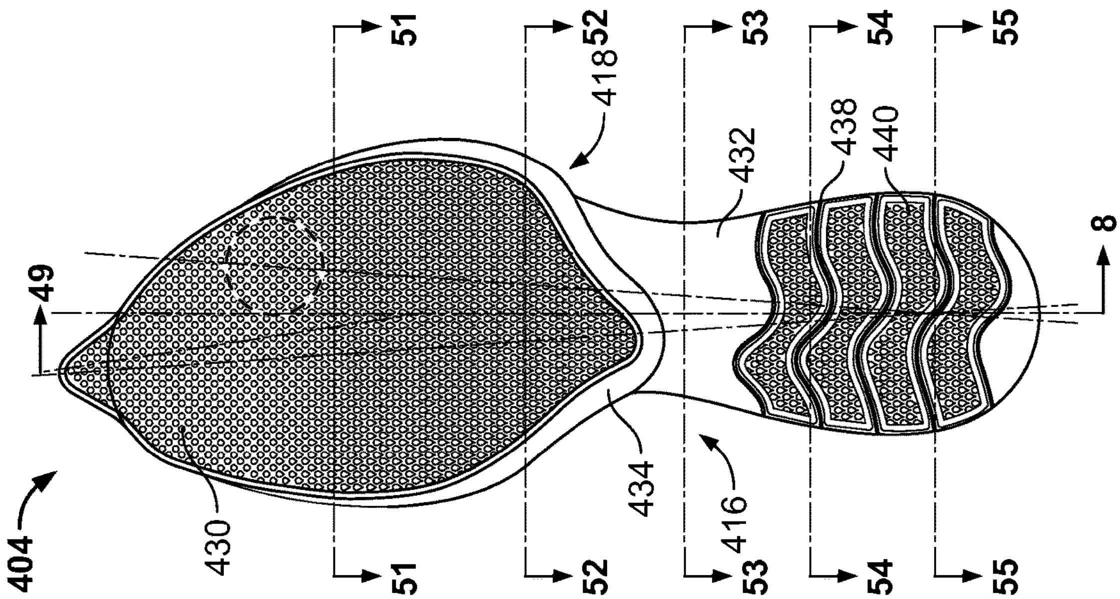


FIG. 47

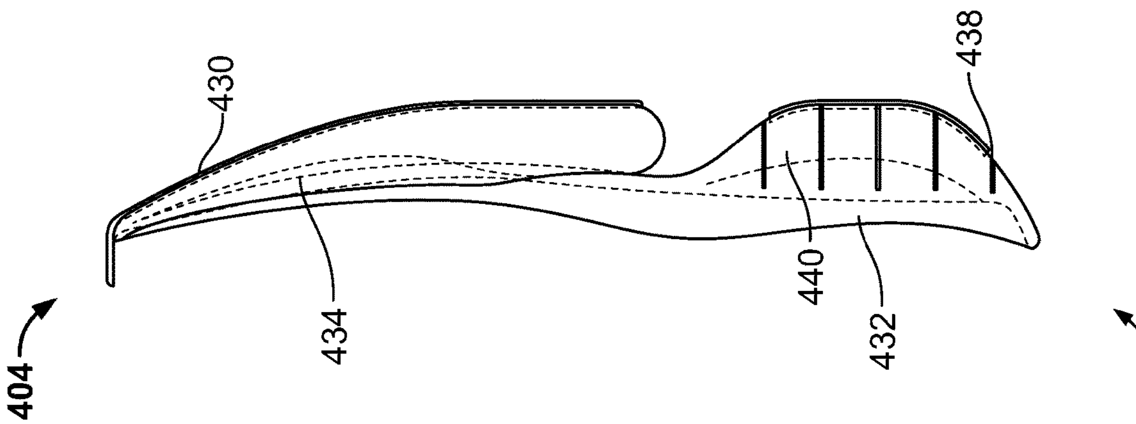


FIG. 48

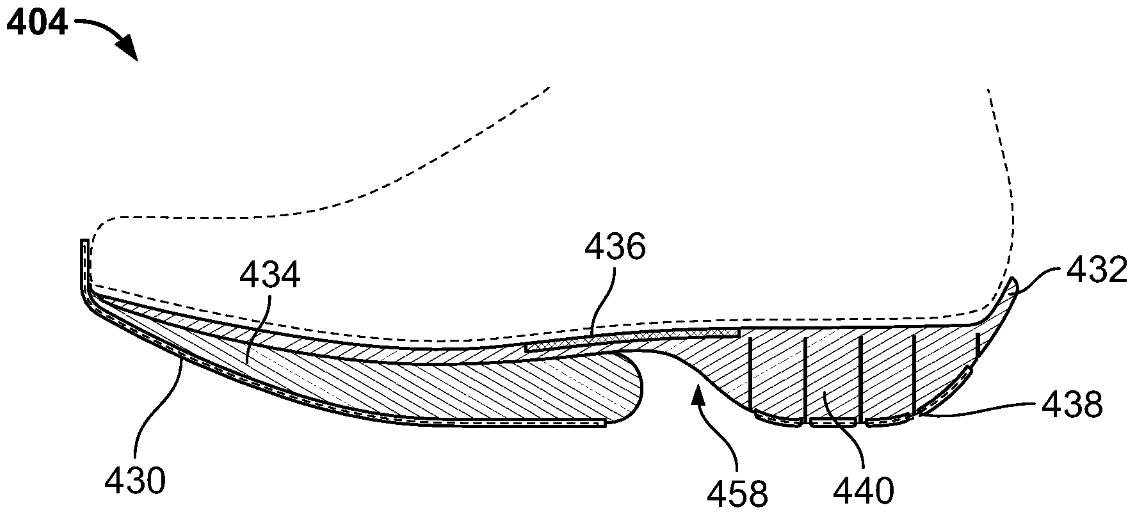


FIG. 49

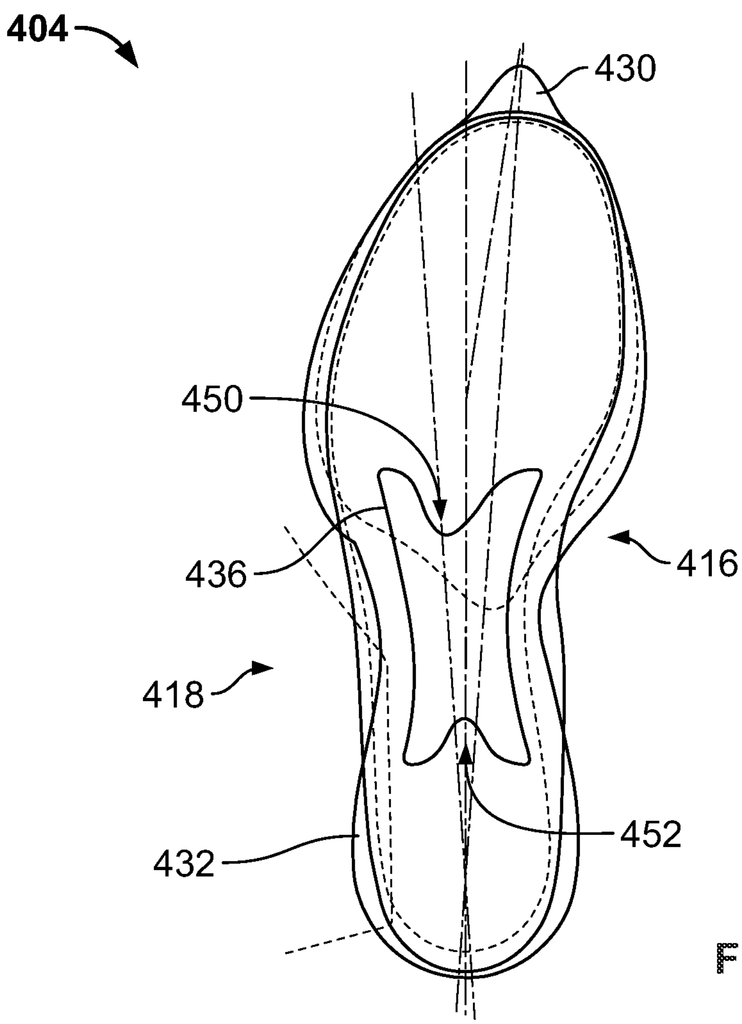


FIG. 50

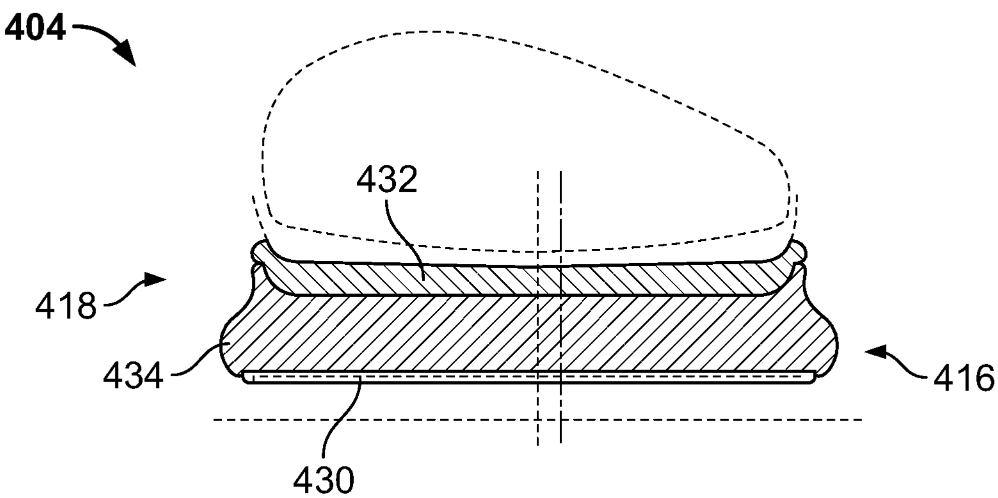


FIG. 51

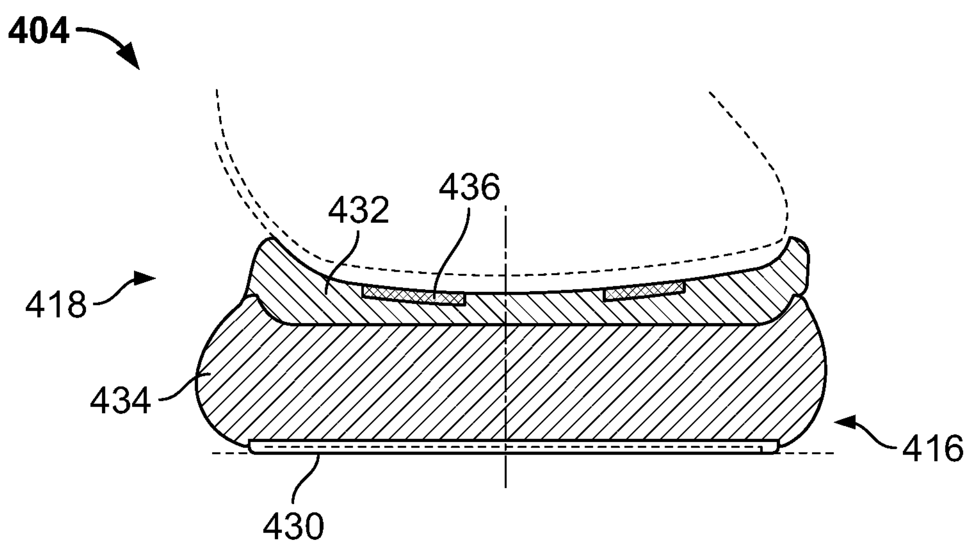


FIG. 52

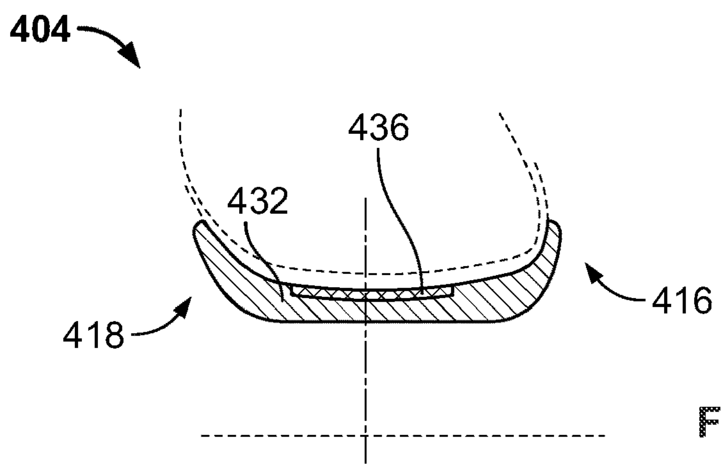


FIG. 53

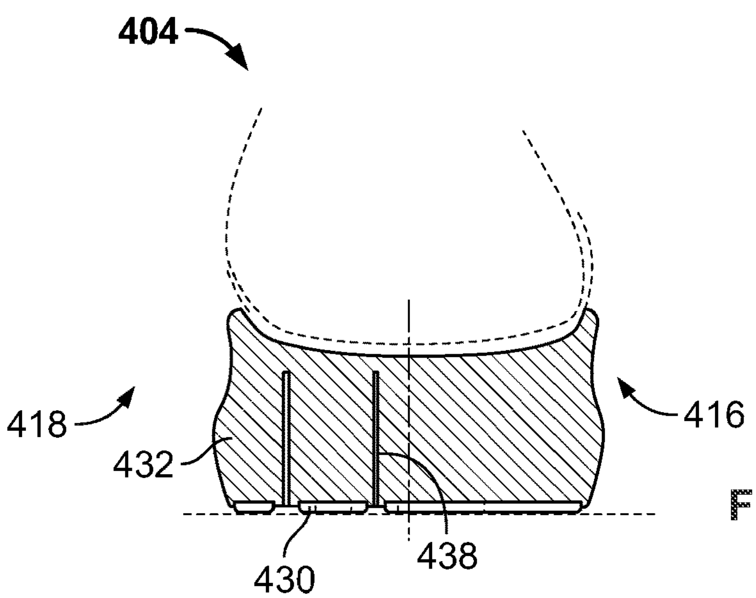


FIG. 54

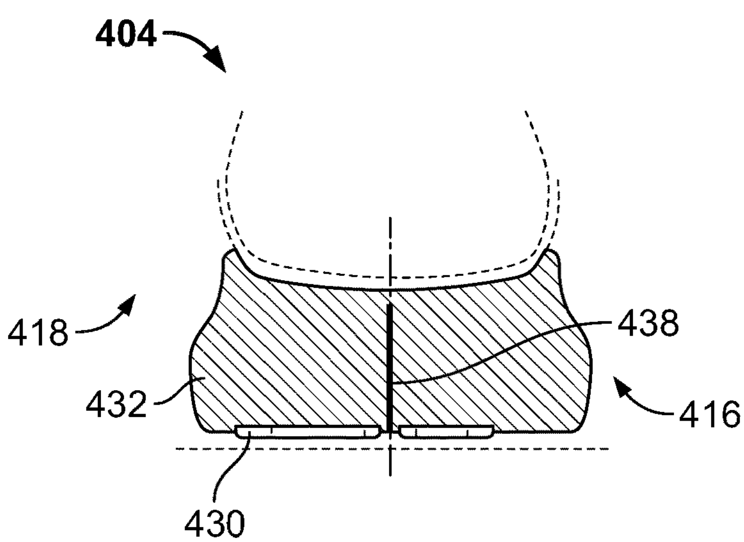


FIG. 55

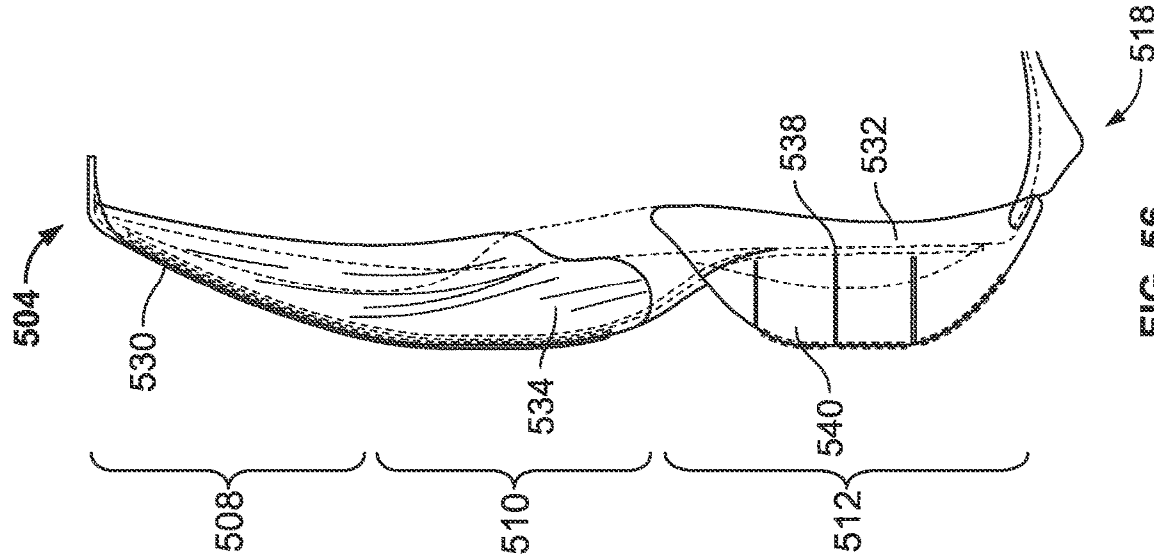


FIG. 56

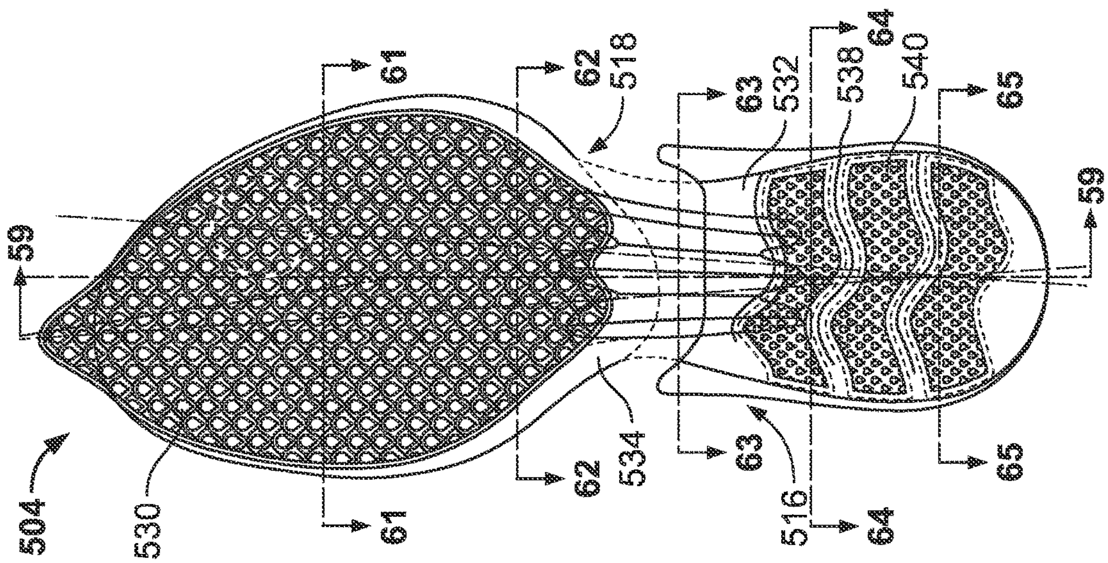


FIG. 57

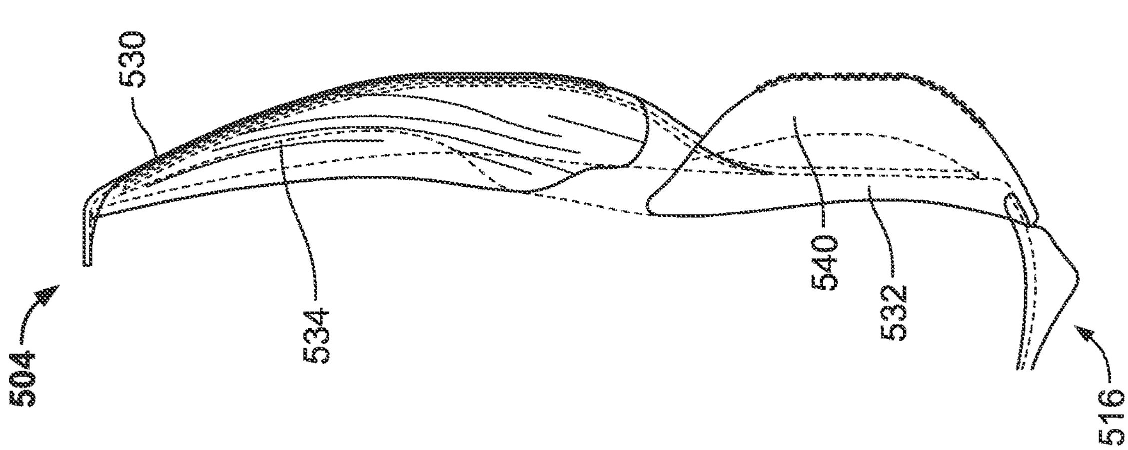
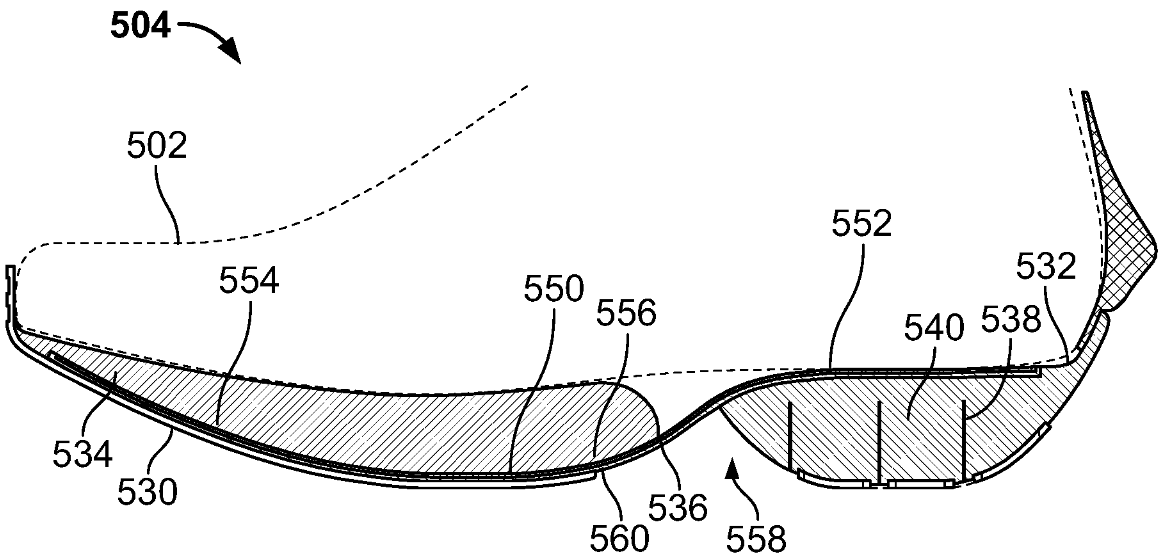


FIG. 58


504
502
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532
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538
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536
558

FIG. 59

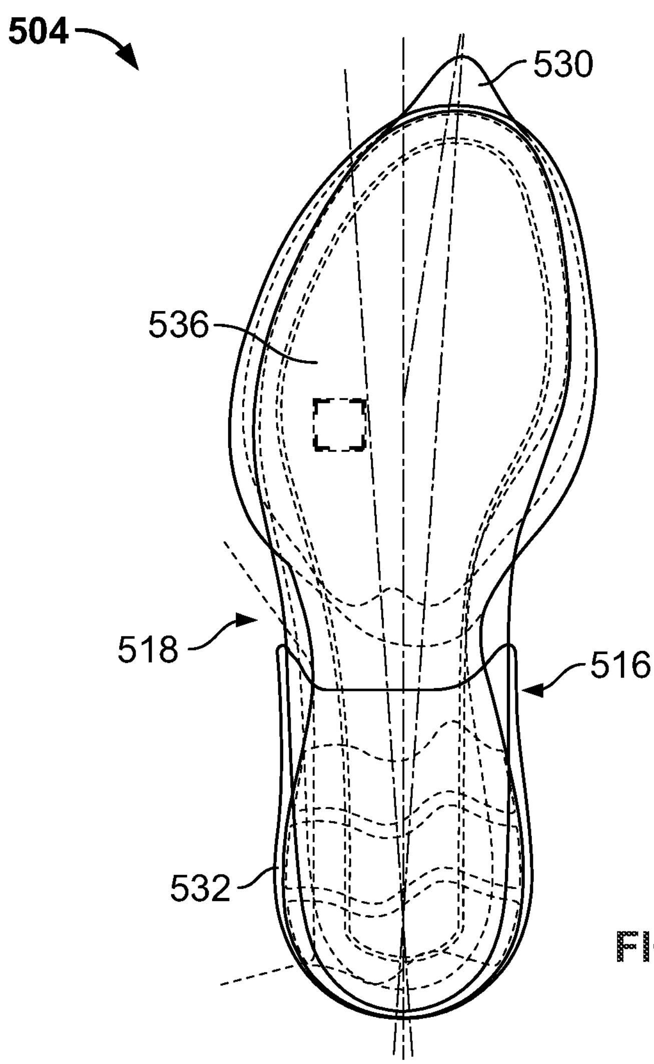

504
530
536
518
516
532

FIG. 60

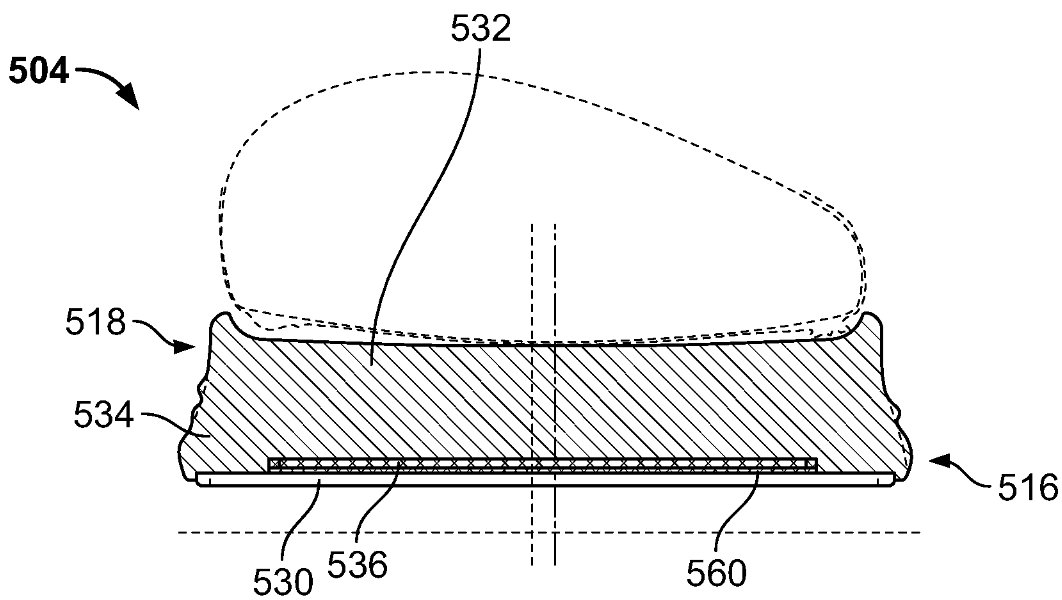


FIG. 61

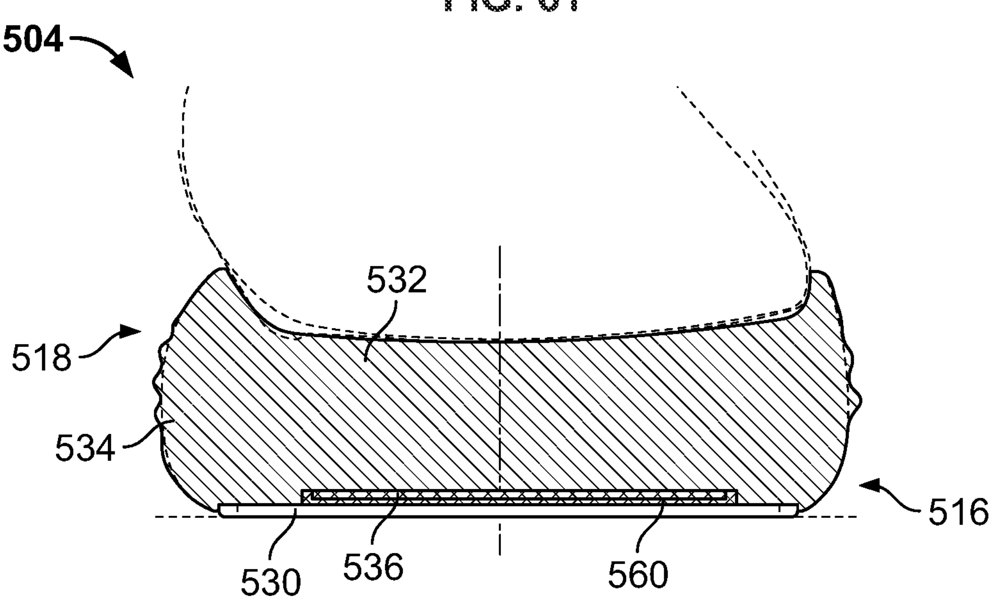


FIG. 62

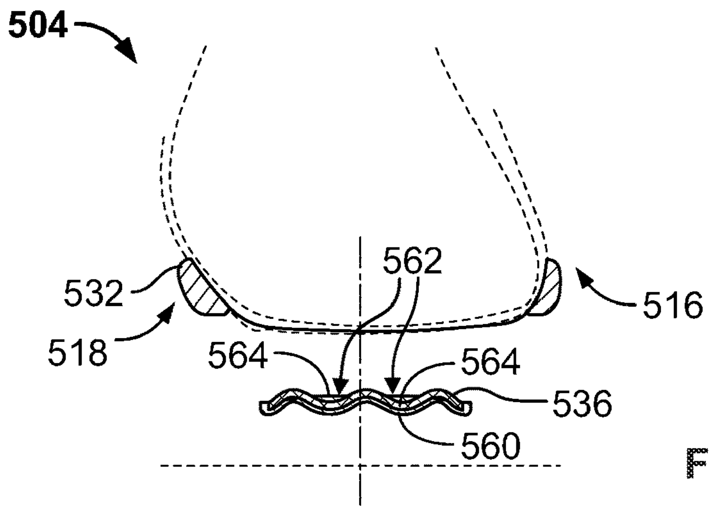


FIG. 63

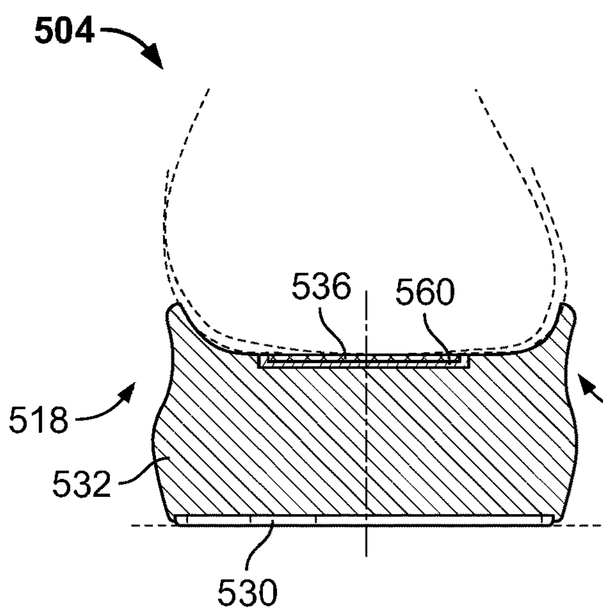


FIG. 64

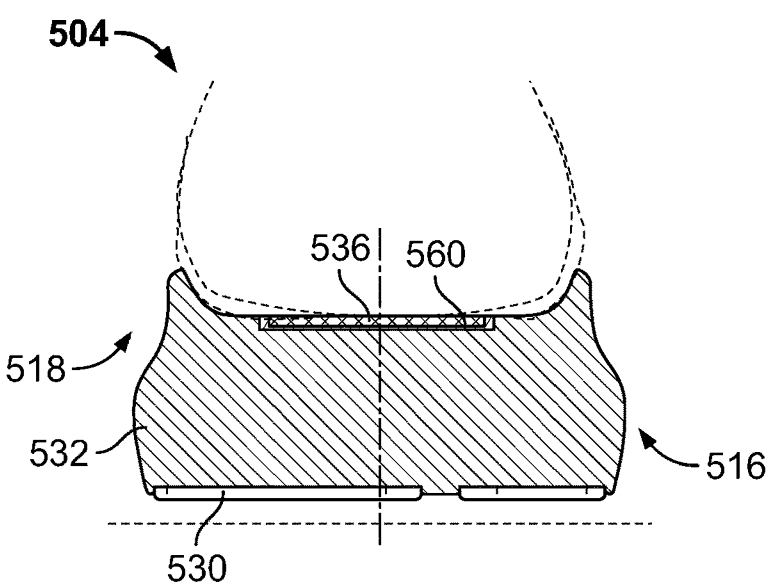


FIG. 65

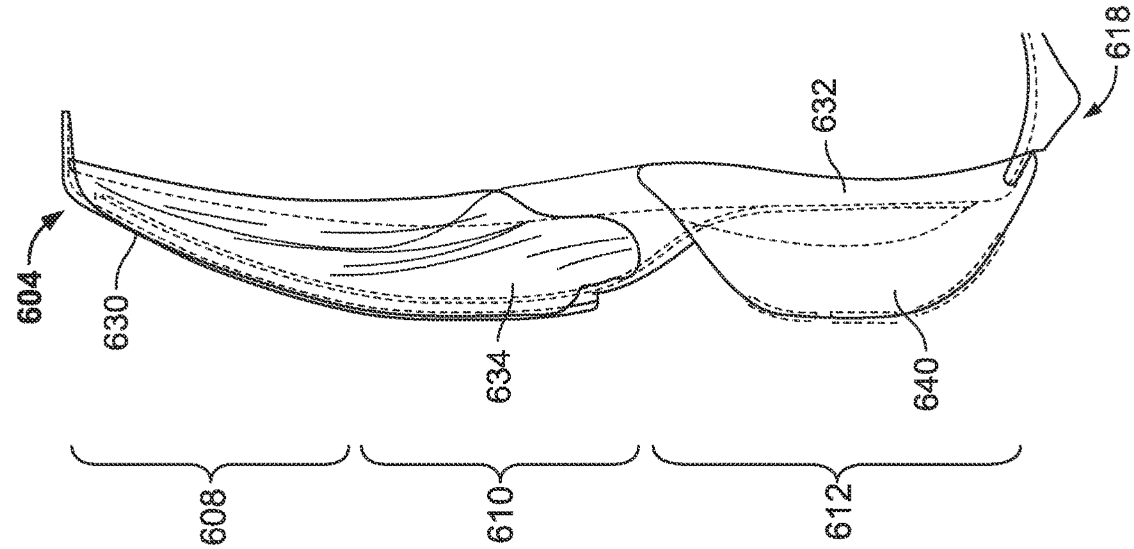


FIG. 66

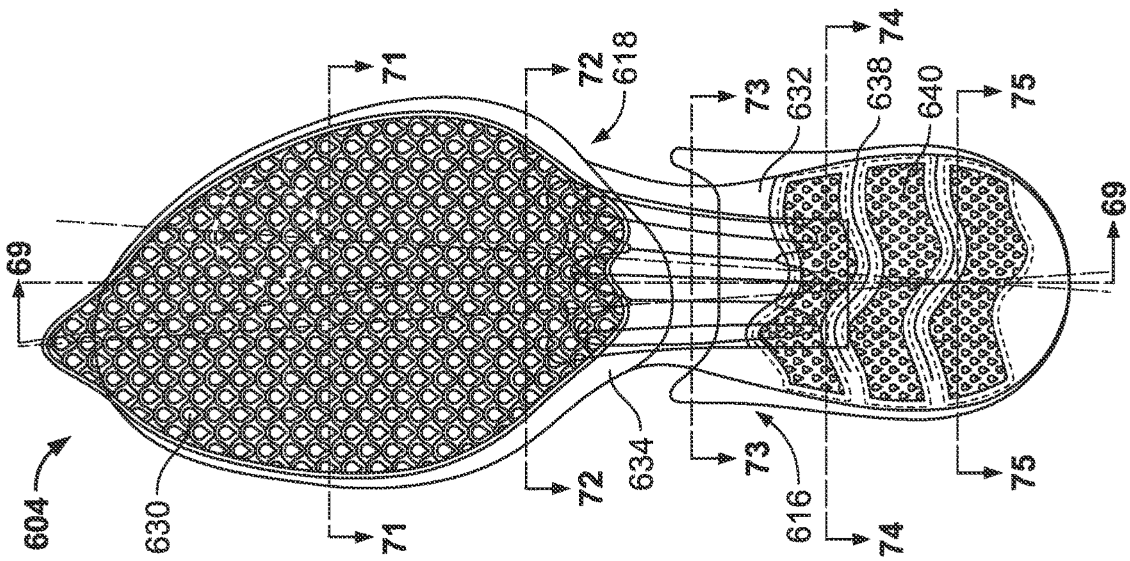


FIG. 67

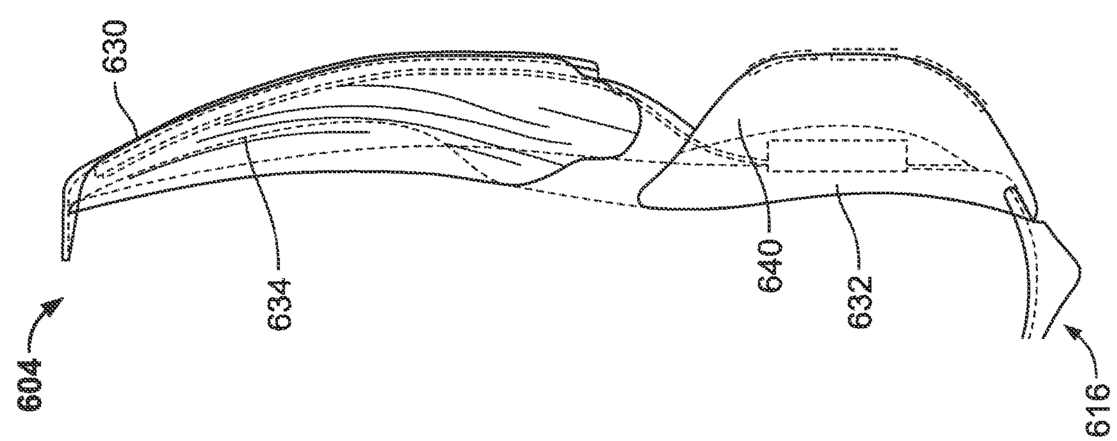


FIG. 68

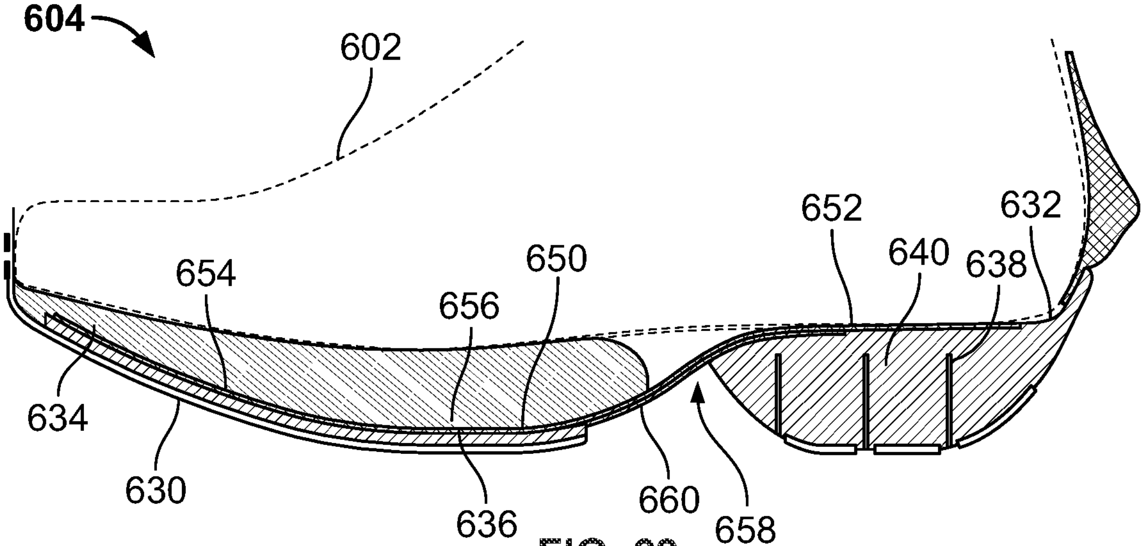

604
602
652
632
640
638
654
650
656
634
630
636
660
658

FIG. 69

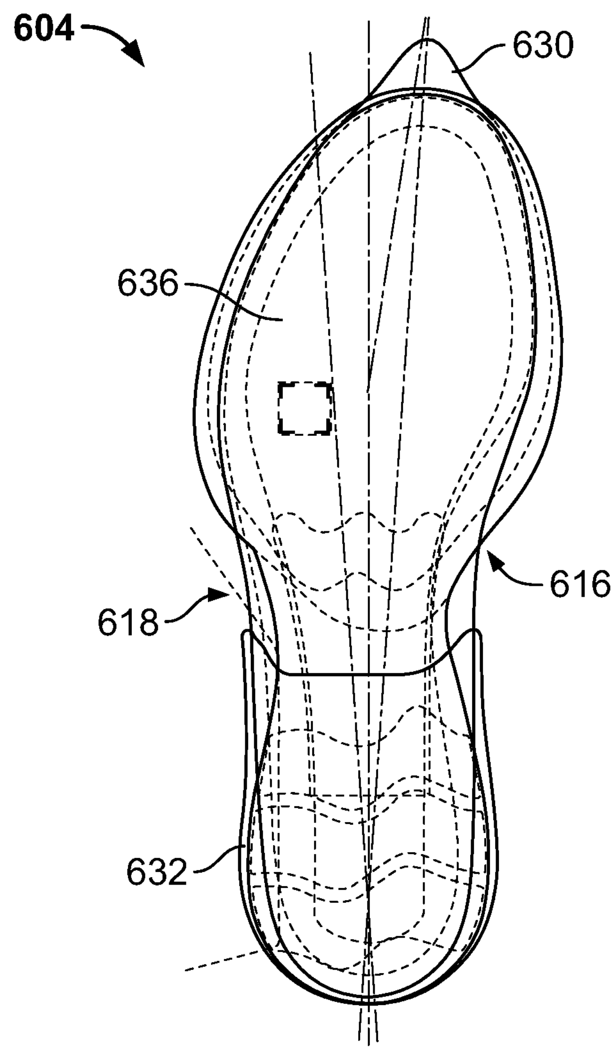

604
630
636
616
618
632

FIG. 70

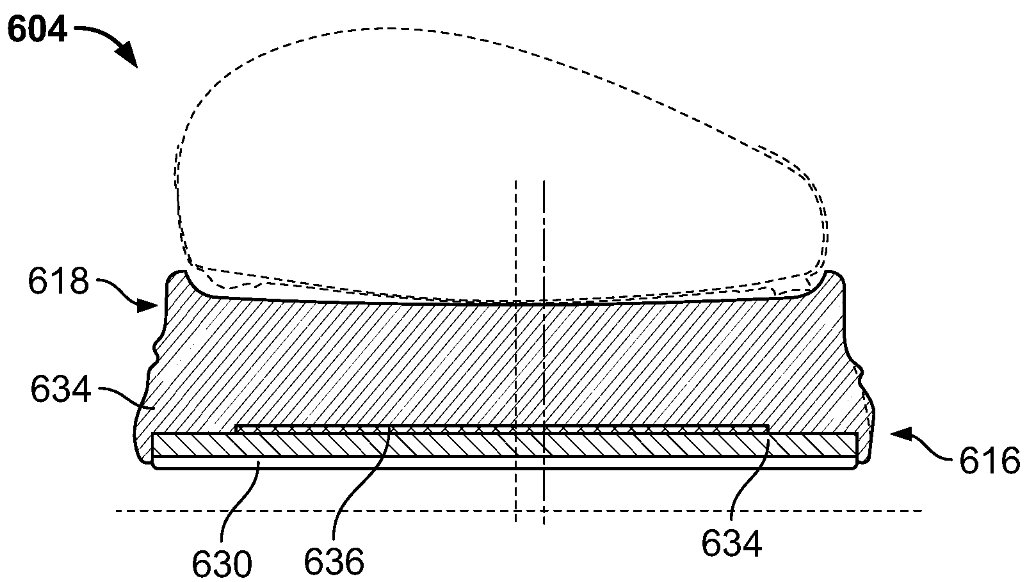


FIG. 71

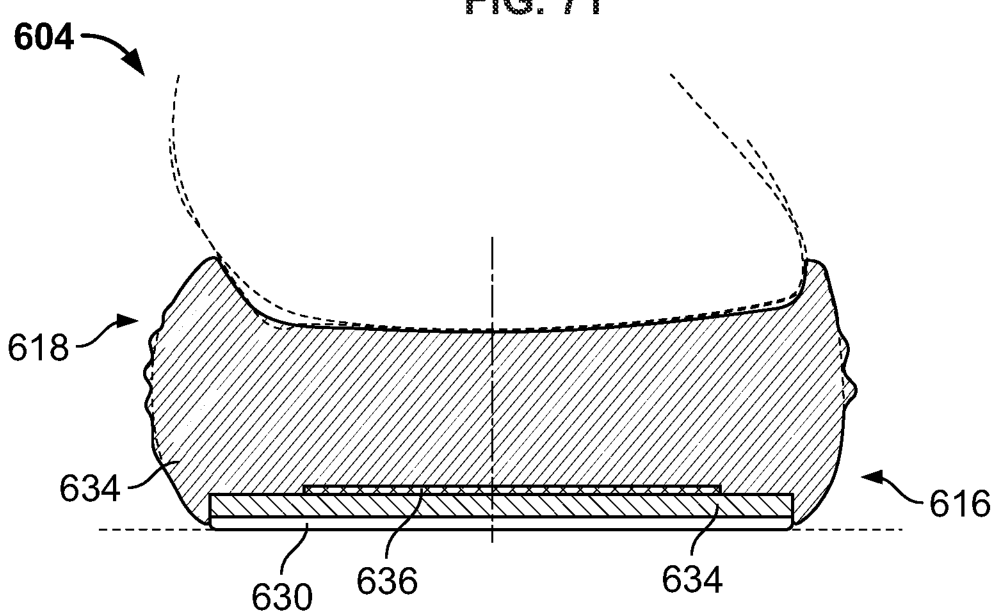


FIG. 72

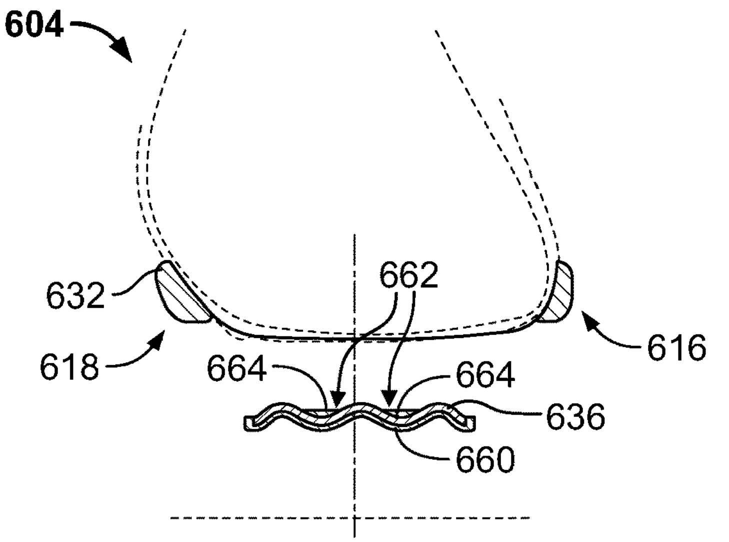


FIG. 73

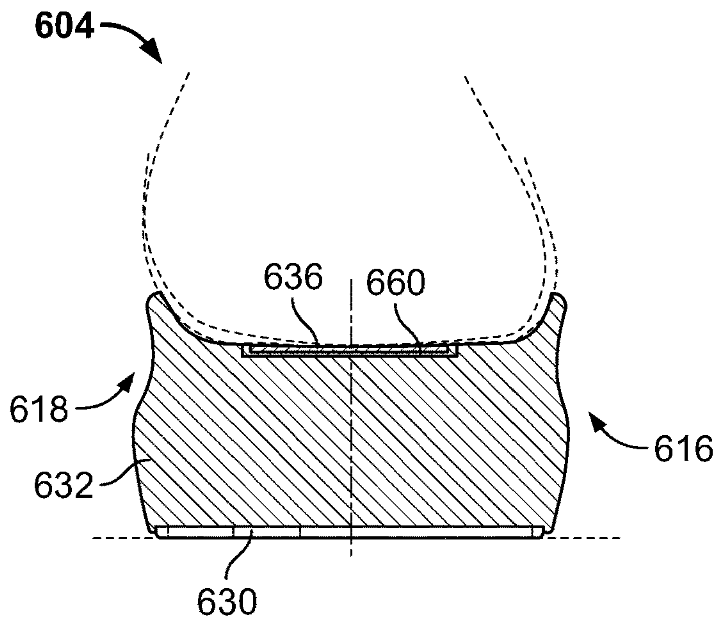


FIG. 74

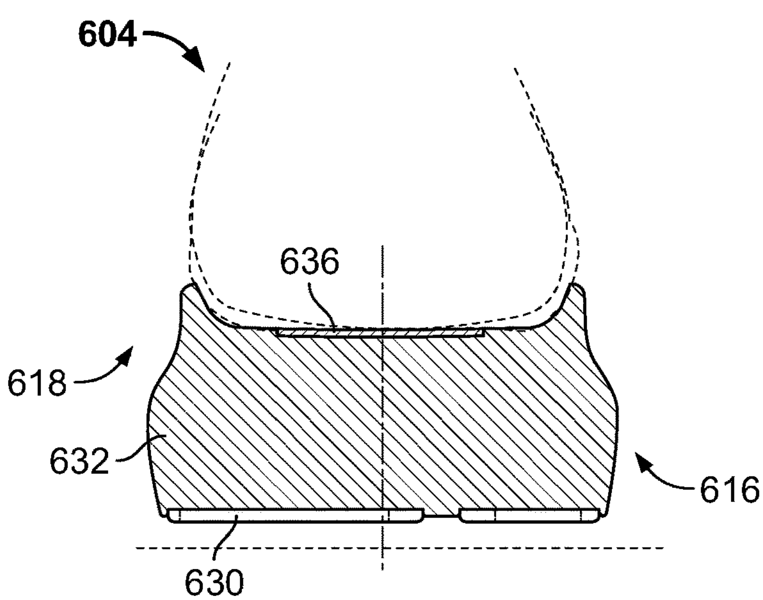


FIG. 75

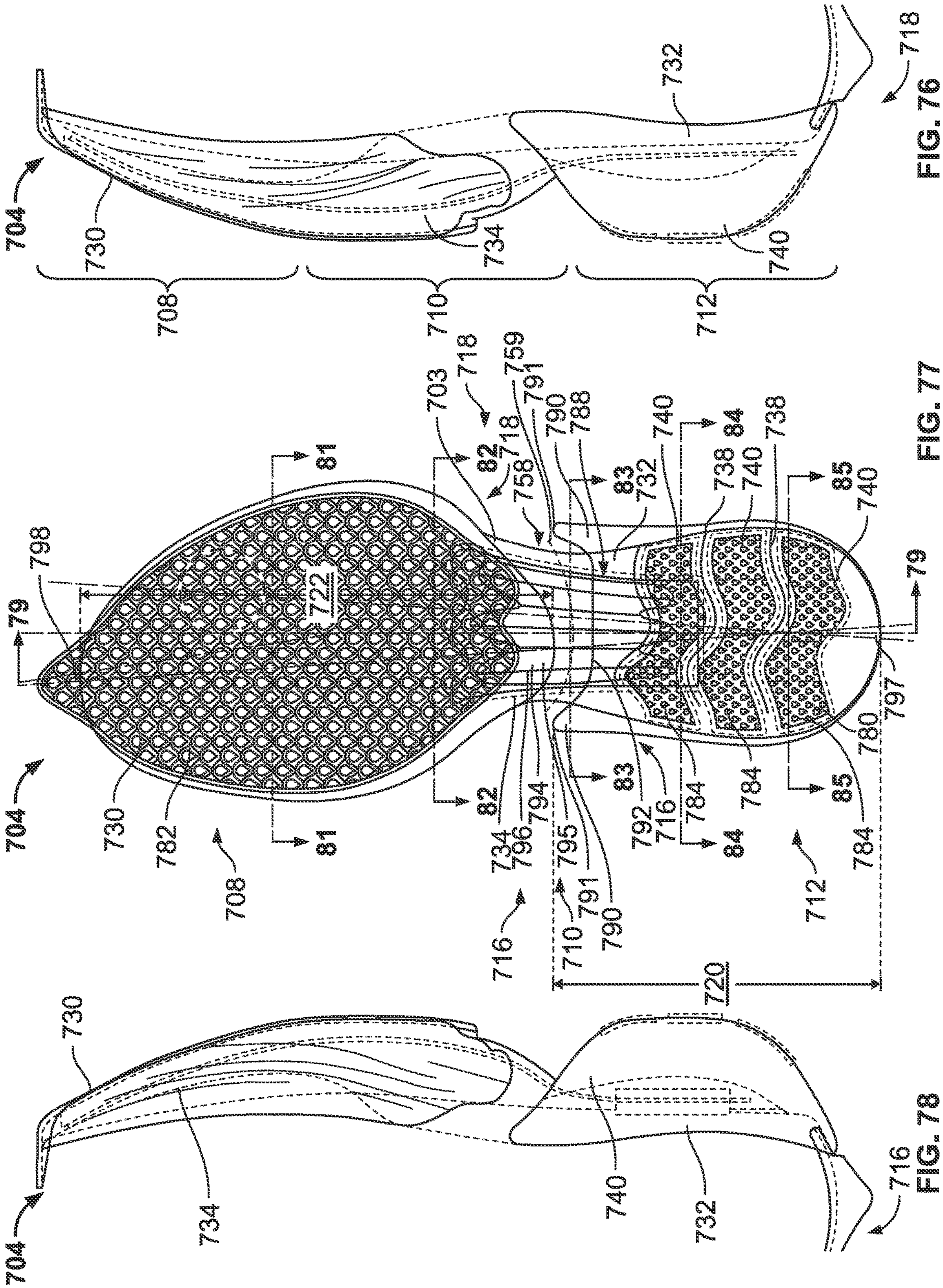
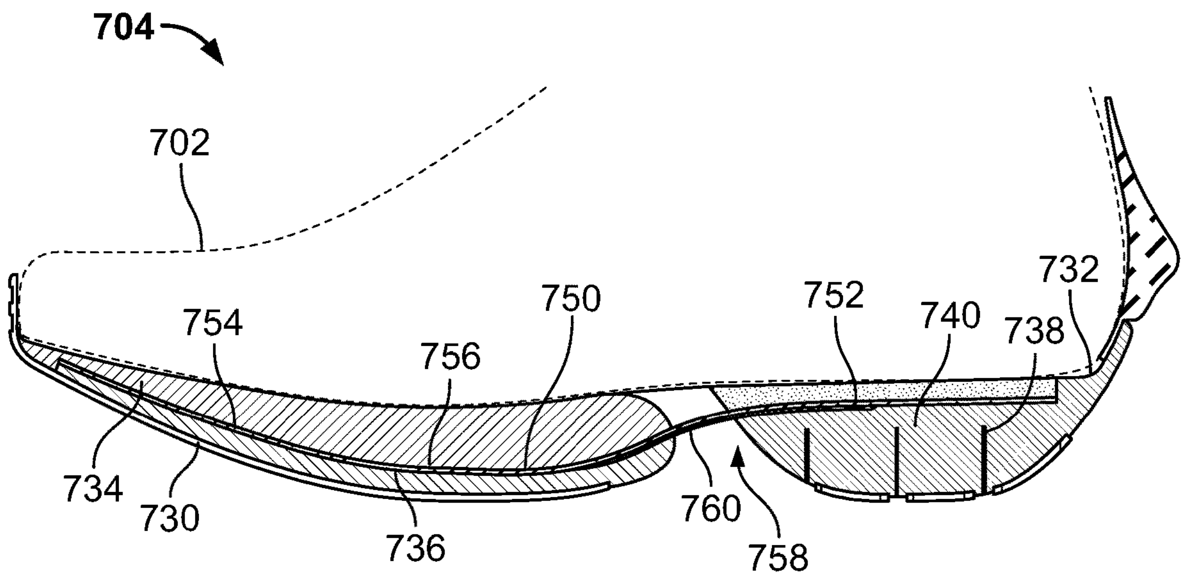


FIG. 76

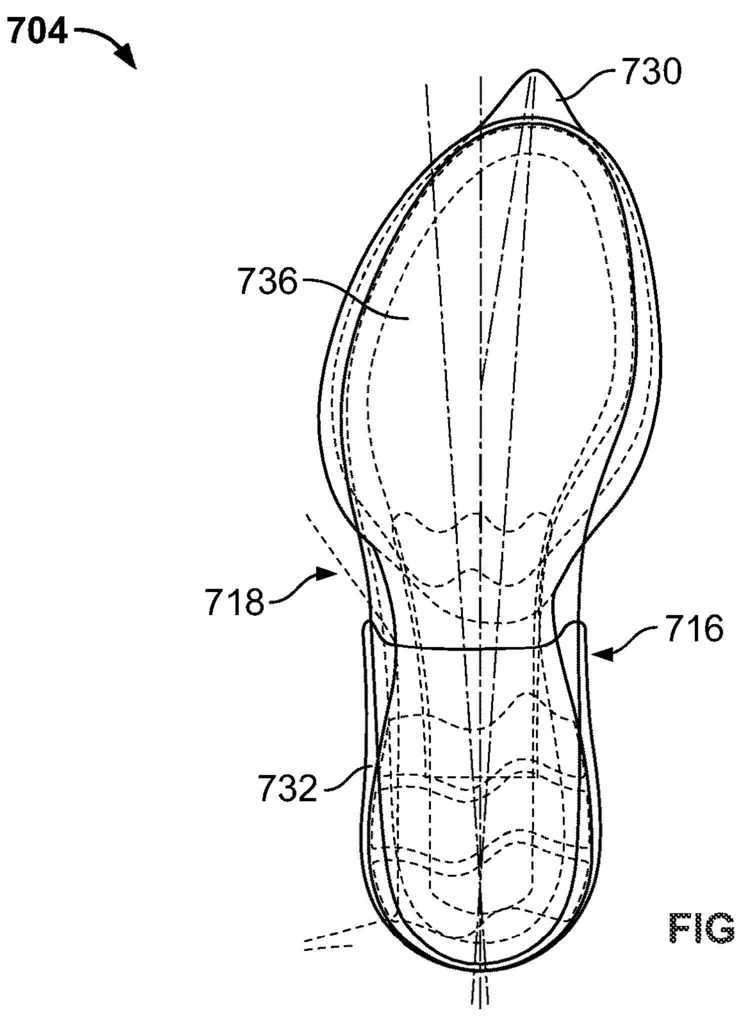
FIG. 77

FIG. 78



704
702
754
756
750
752
740
732
738
734
730
736
760
758

FIG. 79



704
730
736
718
716
732

FIG. 80

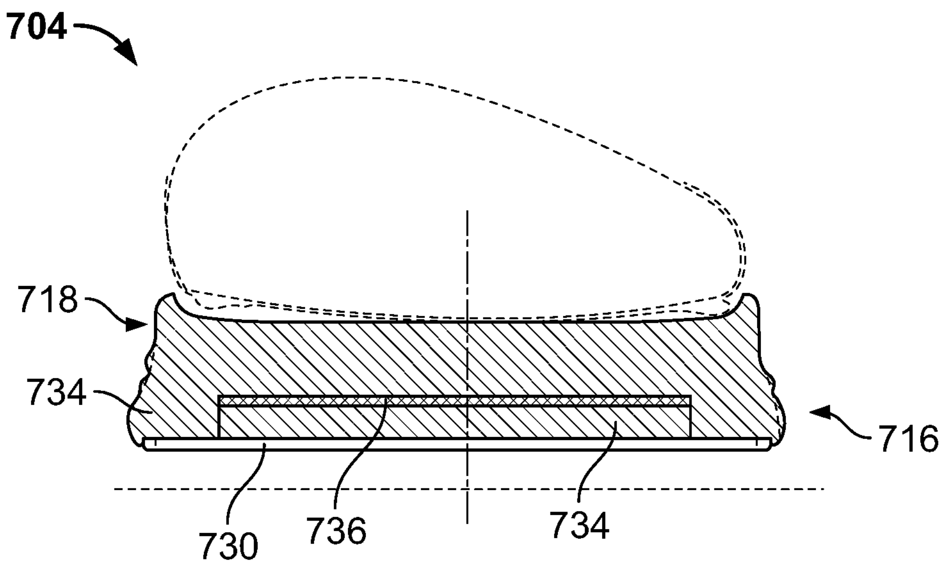


FIG. 81

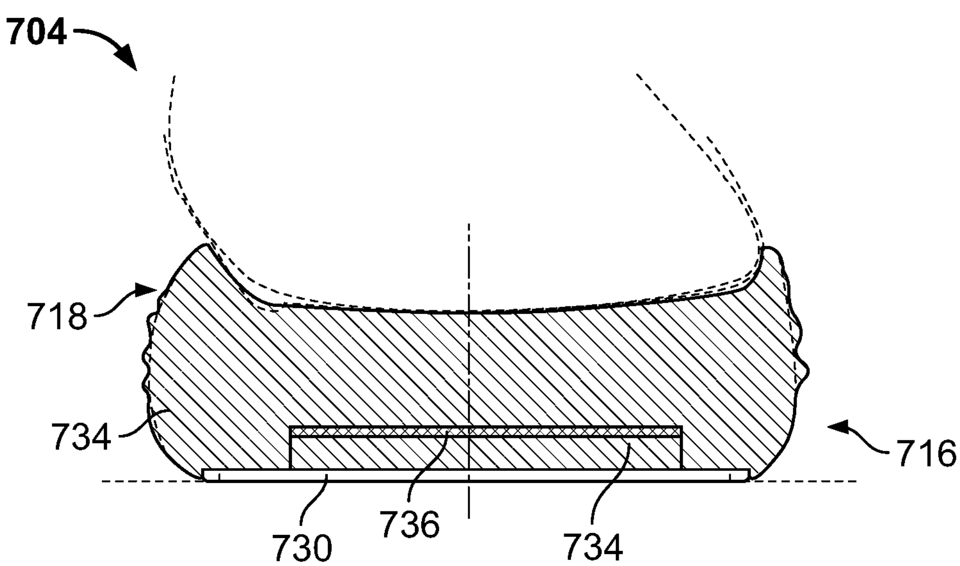


FIG. 82

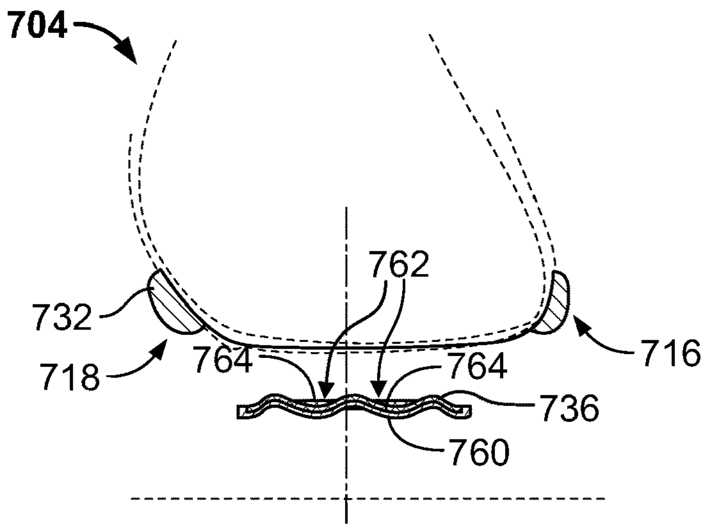


FIG. 83

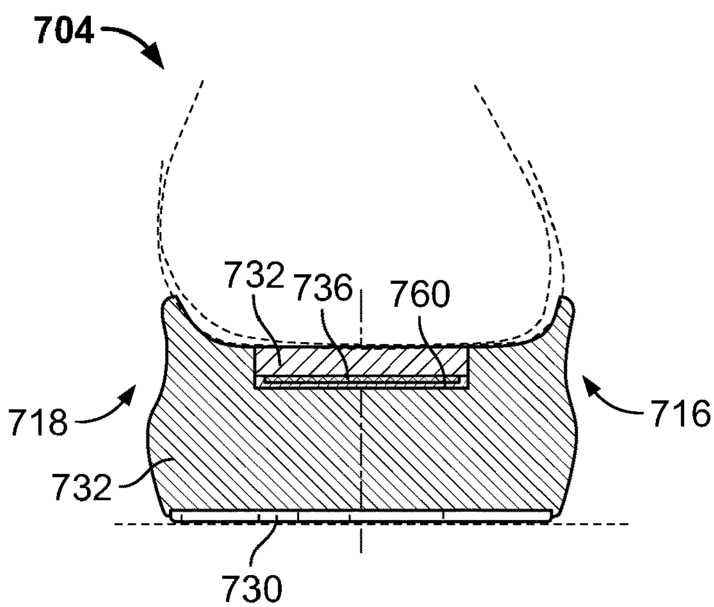


FIG. 84

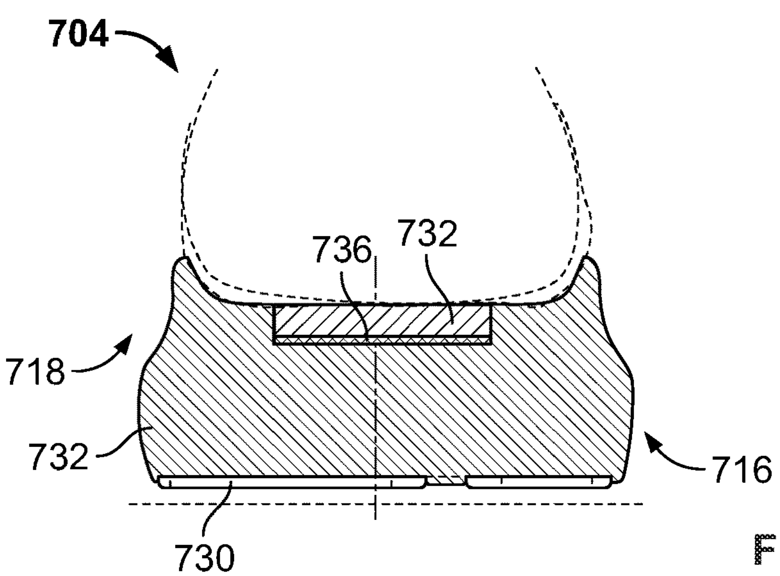


FIG. 85

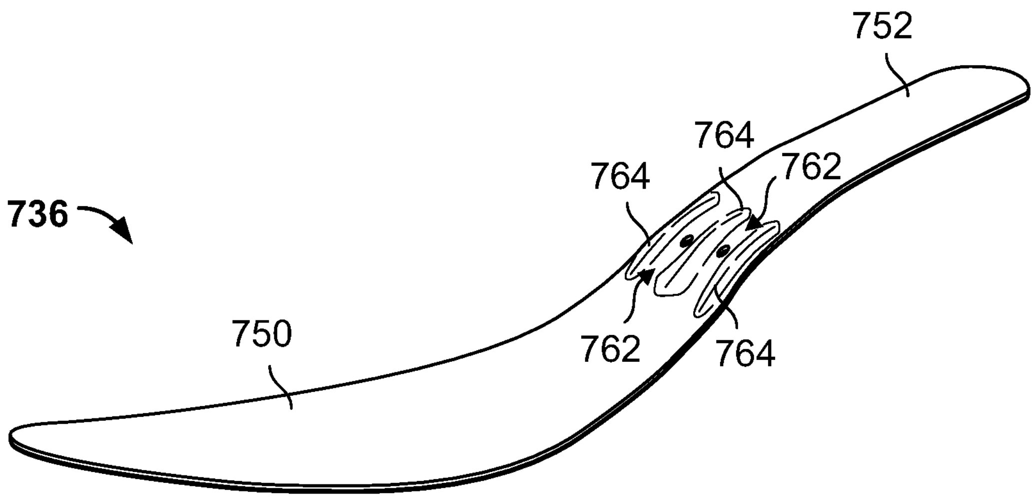


FIG. 86

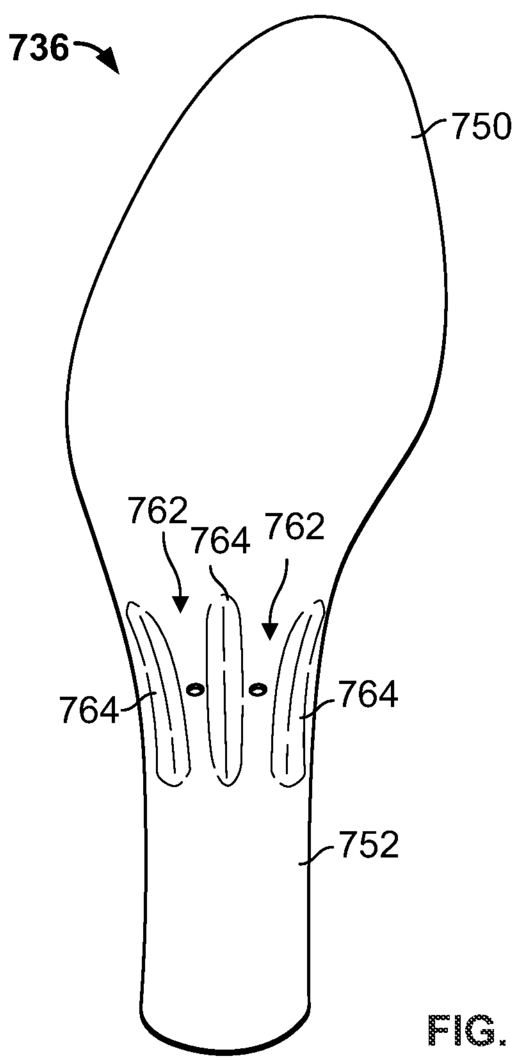


FIG. 87

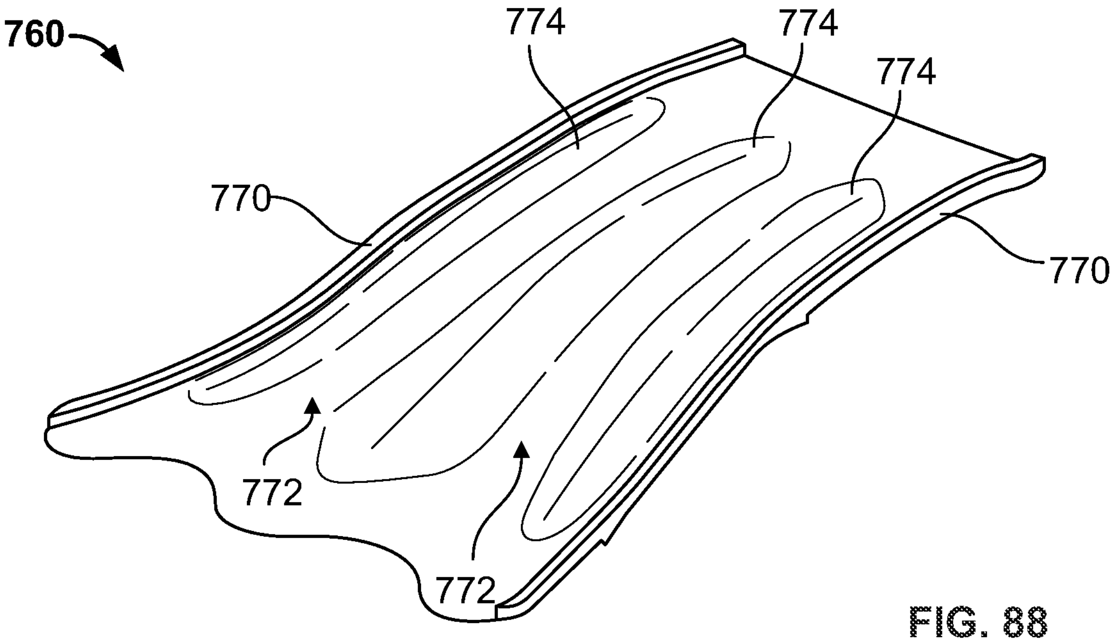


FIG. 88

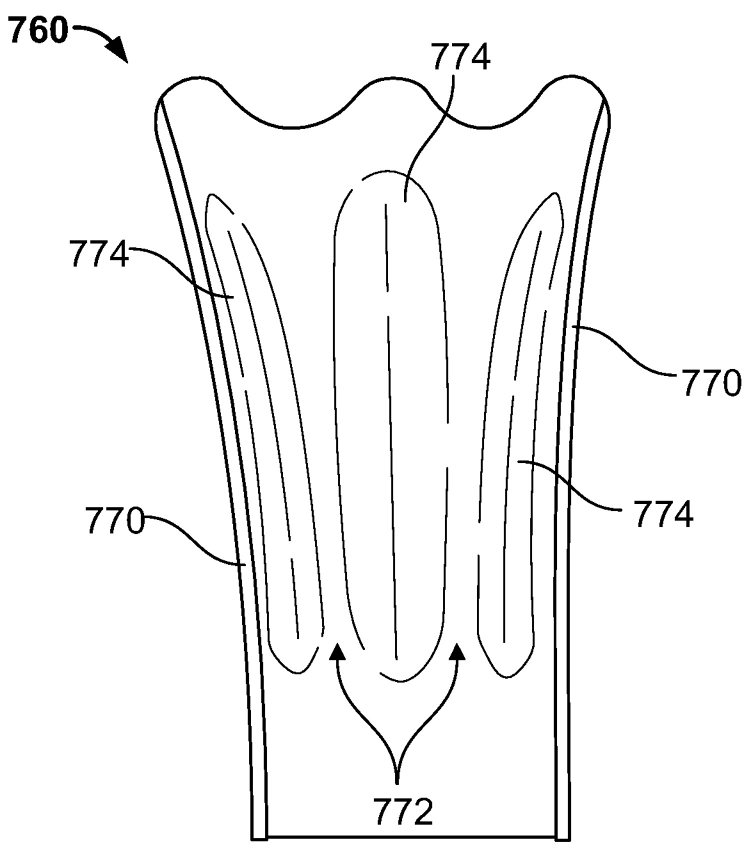


FIG. 89

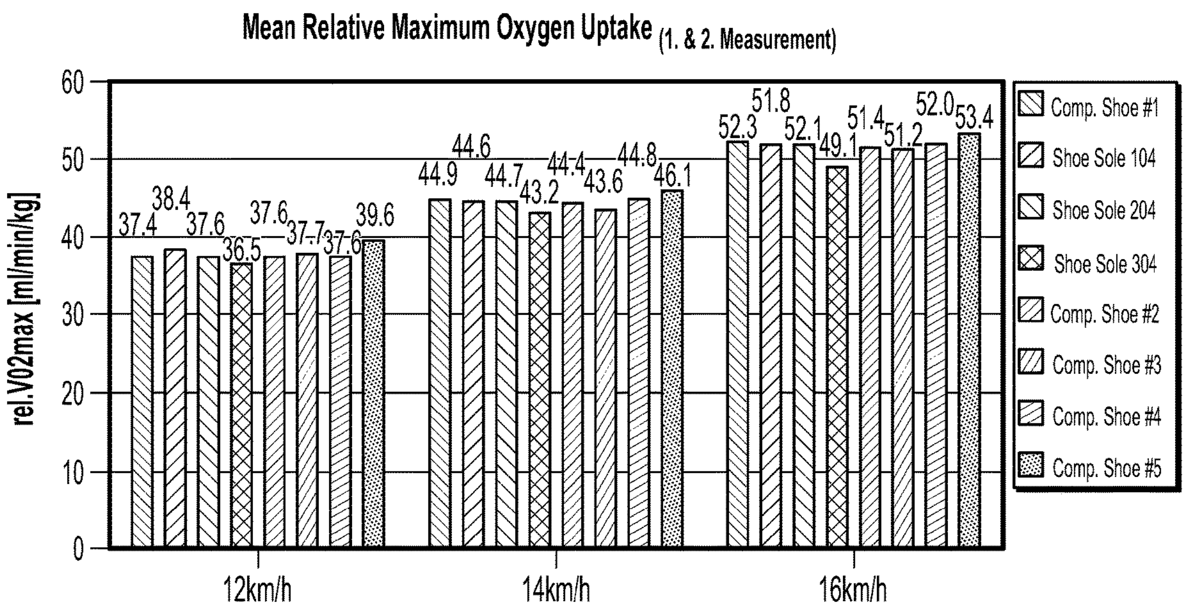

Mean Relative Maximum Oxygen Uptake (1. & 2. Measurement)
rel.V02max [ml/min/kg]
0
10
20
30
40
50
60
37.4
38.4
37.6
36.5
37.6
37.7
37.6
39.6
44.9
44.6
44.7
43.2
44.4
43.6
44.8
46.1
52.3
51.8
52.1
49.1
51.4
51.2
52.0
53.4
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 90

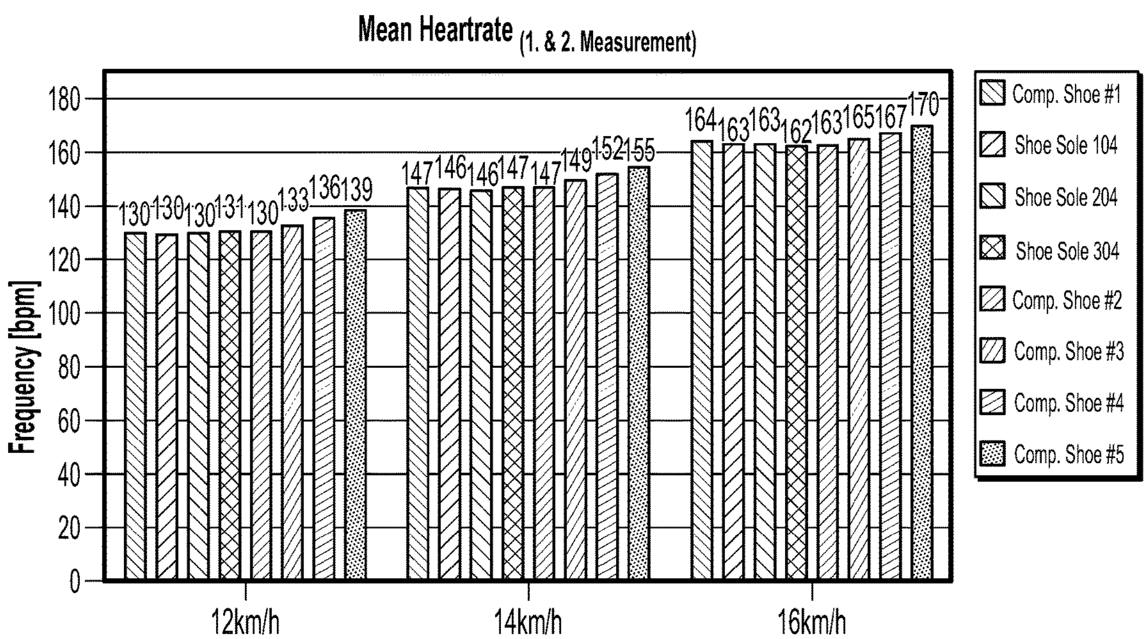

Mean Heartrate (1. & 2. Measurement)
Frequency [bpm]
0
20
40
60
80
100
120
140
160
180
130
130
130
131
130
133
136
139
147
146
146
147
147
149
152
155
164
163
163
162
163
165
167
170
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 91

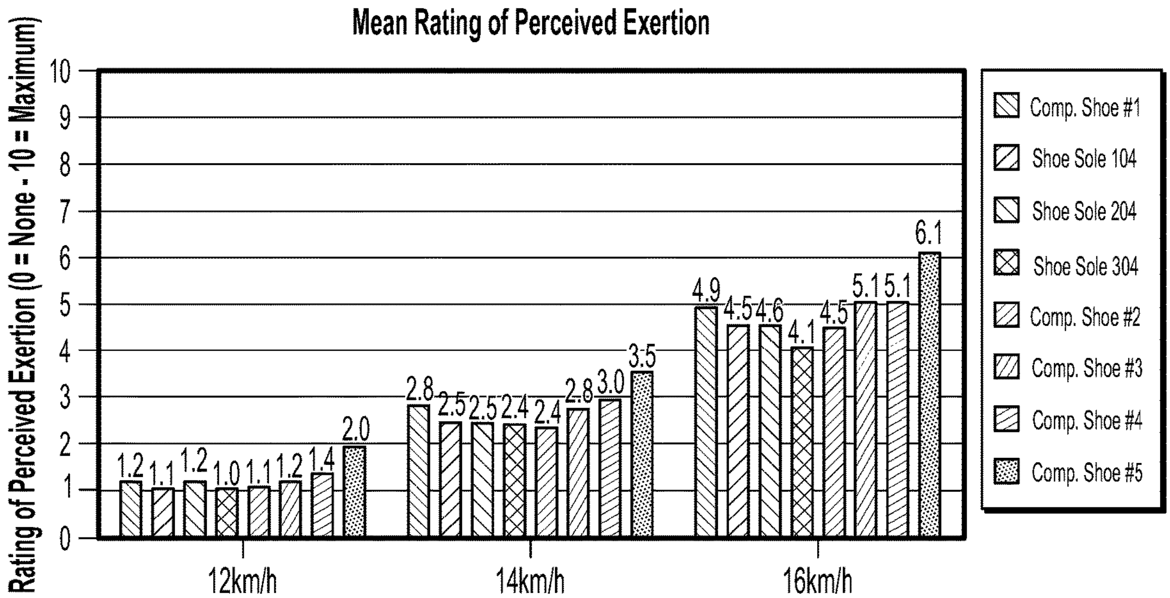

Mean Rating of Perceived Exertion
Rating of Perceived Exertion (0 = None - 10 = Maximum)
10
9
8
7
6
5
4
3
2
1
0
1.2 1.1 1.2 1.0 1.1 1.2 1.4 2.0
2.8 2.5 2.5 2.4 2.4 2.8 3.0 3.5
4.9 4.5 4.6 4.1 4.5 5.1 5.1 6.1
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 92

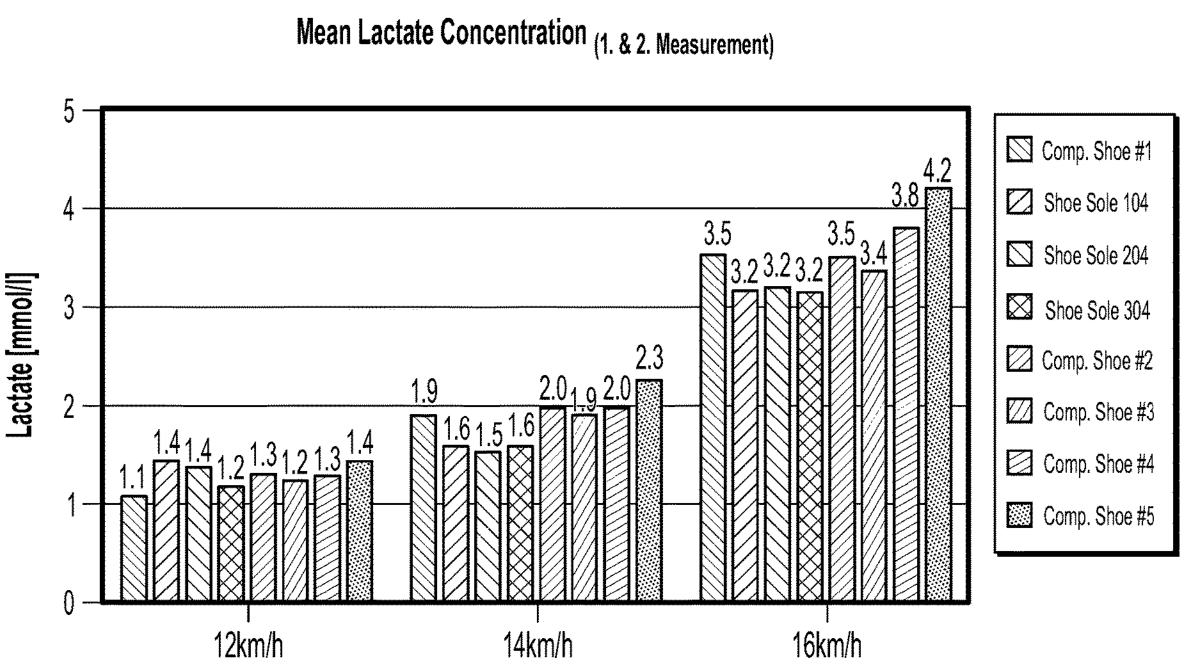

Mean Lactate Concentration (1. & 2. Measurement)
Lactate [mmol/l]
5
4
3
2
1
0
1.1 1.4 1.4 1.2 1.3 1.2 1.3 1.4
1.9 1.6 1.5 1.6 2.0 1.9 2.0 2.3
3.5 3.2 3.2 3.2 3.5 3.4 3.8 4.2
12km/h
14km/h
16km/h
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 93

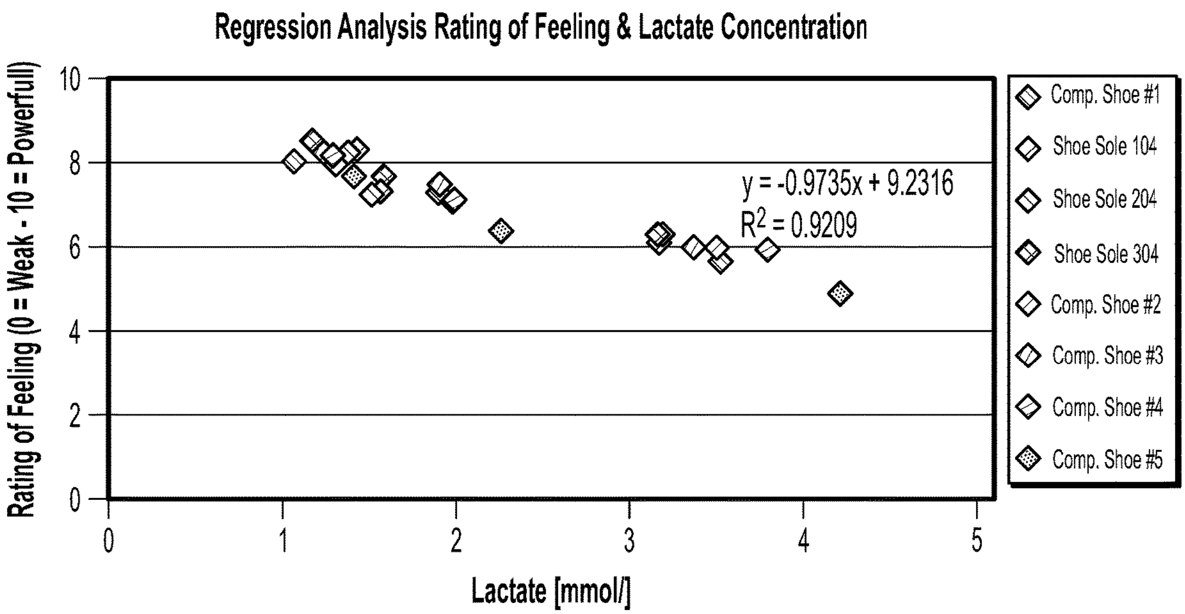

Regression Analysis Rating of Feeling & Lactate Concentration
Rating of Feeling (0 = Weak - 10 = Powerfull)
10
8
6
4
2
0
0
1
2
3
4
5
Lactate [mmol/]
y = -0.9735x + 9.2316
R2 = 0.9209
Comp. Shoe #1
Shoe Sole 104
Shoe Sole 204
Shoe Sole 304
Comp. Shoe #2
Comp. Shoe #3
Comp. Shoe #4
Comp. Shoe #5

FIG. 94

ARTICLE OF FOOTWEAR HAVING A SOLE PLATE

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 17/404,388, filed Aug. 17, 2021, which claims the benefit of U.S. Provisional Patent Application 63/067,073, filed on Aug. 18, 2020, the entire contents of which is hereby incorporated by reference, for any and all purposes.

REFERENCE REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

SEQUENCE LISTING

Not applicable

BACKGROUND

1. Field of the Invention

The present disclosure relates generally to an article of footwear including a sole plate.

2. Description of the Background

Many conventional shoes or other articles of footwear generally comprise an upper and a sole attached to a lower end of the upper. Conventional shoes further include an internal space, i.e., a void or cavity, which is created by interior surfaces of the upper and sole, that receives a foot of a user before securing the shoe to the foot. The sole attaches to a lower surface or boundary of the upper and positions itself between the upper and the ground. As a result, the sole typically provides stability and cushioning to the user when the shoe is being worn. In some instances, the sole may include multiple components, such as an outsole, a midsole, and an insole. The outsole may provide traction to a bottom surface of the sole, and the midsole may be attached to an inner surface of the outsole, and may provide cushioning or added stability to the sole. For example, a sole may include a particular foam material that may increase stability at one or more desired locations along the sole, or a foam material that may reduce stress or impact energy on the foot or leg when a user is running, walking, or engaged in another activity. The sole may also include additional components, such as plates, embedded with the sole to increase the overall stiffness of the sole and reduce energy loss during use.

The upper generally extends upward from the sole and defines an interior cavity that completely or partially encases a foot. In most cases, the upper extends over the instep and toe regions of the foot, and across medial and lateral sides thereof. Many articles of footwear may also include a tongue that extends across the instep region to bridge a gap between edges of medial and lateral sides of the upper, which define an opening into the cavity. The tongue may also be disposed below a lacing system and between medial and lateral sides of the upper, to allow for adjustment of shoe tightness. The tongue may further be manipulable by a user to permit entry or exit of a foot from the internal space or cavity. In addition, the lacing system may allow a user to adjust certain dimen-

sions of the upper or the sole, thereby allowing the upper to accommodate a wide variety of foot types having varying sizes and shapes.

The upper of many shoes may comprise a wide variety of materials, which may be utilized to form the upper and chosen for use based on one or more intended uses of the shoe. The upper may also include portions comprising varying materials specific to a particular area of the upper. For example, added stability may be desirable at a front of the upper or adjacent a heel region so as to provide a higher degree of resistance or rigidity. In contrast, other portions of a shoe may include a soft woven textile to provide an area with stretch-resistance, flexibility, air-permeability, or moisture-wicking properties.

However, in many cases, articles of footwear having uppers with an increased comfort and better fit are desired, along with soles having improved cushioning systems or structural characteristics such as a sole plate to add rigidity or spring-like properties.

SUMMARY

An article of footwear, as described herein, may have various configurations. The article of footwear may have an upper and a sole structure connected to the upper.

According to one aspect, the present disclosure provides a sole structure for an article of footwear. The sole structure can include a first cushioning member positioned in a heel region of the sole structure and a second cushioning member positioned in a forefoot region of the sole structure. A gap can extend between the first cushioning member and the second cushioning member in a midfoot region of the sole structure and at least one of the first cushioning member or the second cushioning member can be a supercritical foam with pockets of nitrogen gas therein. That is, the first cushioning member can be a supercritical foam with pockets of nitrogen gas therein and/or the second cushioning member can be a supercritical foam with pockets of gas therein.

In some embodiments, the article of footwear can further include an outsole defining a ground engaging surface. The outsole can include a first outsole portion coupled to the first cushioning member and a second outsole portion coupled to the second cushioning member so that the ground engaging surface is not continuous along the midfoot region. In some cases, the first outsole portion can include a first heel outsole portion and a second heel outsole portion that are spaced apart from one another. A groove can extend between the first heel outsole portion and the second heel outsole portion.

In some embodiments, the gap can extend along a non-linear path between a lateral side of the sole structure and a medial side of the sole structure. In some cases, the non-linear path can be a generally U-shaped path.

In some embodiments, the first cushioning member can include an anterior protrusion that extends toward the second cushioning member and the second cushioning member can include a posterior protrusion that extends toward the first cushioning member. The anterior protrusion and the posterior protrusion can terminate within the midfoot region of the sole structure. In some cases, a distal end (i.e., a toe end) of the anterior protrusion can be disposed closer to a toe end of the sole structure than is a distal end (i.e., a heel end) of the posterior protrusion.

In some embodiments, the first cushioning member can include a distal end at least partially in a midfoot region of the sole structure. In some embodiments, the second cushioning member can include a distal end at least partially in the midfoot region. In some cases, the first cushioning

member and the second cushioning member can overlap in the midfoot region of the sole structure, such that at least a portion of the distal end of the first cushioning member extends past at least a portion of the distal end of the second cushioning member.

In some embodiments, the supercritical fluid can be nitrogen. The super critical foam can be formed by pressurizing a mixture of the supercritical fluid (i.e., supercritical nitrogen) and a molten material of the cushioning member and then releasing the pressure to convert the supercritical fluid to a gas. The pressure can then be released to convert the supercritical fluid to a gas, which can cause the material to expand and foam, thereby forming the pockets of nitrogen gas therein.

According to another aspect, the present disclosure provides a sole structure for an article of footwear. The sole structure can include a midsole and an outsole. The midsole can include a first cushioning member and a second cushioning member. The first cushioning member can be decoupled from the second cushioning member to define a gap therebetween. The gap can extend from a lateral side of the midsole to a medial side of the midsole. The first cushioning member can extend at leas partially through a midfoot region and can include a distal end that is U-shaped. The second cushioning member can extend at least partially through the midfoot region and can include a rounded distal end. At least one of the first cushioning member or the second cushioning member can be a supercritical foam with pockets of nitrogen gas therein.

In some embodiments, a bottom surface of the upper can be exposed along the gap between the first cushioning member and the second cushioning member. The first cushioning member can define a notch and the second cushioning member can define protrusion that can extend into the notch while maintaining the gap between the first cushioning member and the second cushioning member.

In some embodiments, the first cushioning member can define a first flex region and a second flex region that are separated by flex groove. In some cases, a first outsole portion can include a first outsole element that is coupled to the first flex region and a second outsole element that is coupled to the second flex region.

In some embodiments, the rounded distal end of the second cushioning member can extend into the U-shaped distal end of the first cushioning member, such that the U-shaped distal end of the first cushioning member wraps around the rounded distal end of the second cushioning member.

In some embodiments, the sole structure can further include an outsole that can define a ground engaging surface. The outsole can include a first outsole portion coupled to the first cushioning member and a second outsole portion coupled to the second cushioning member so that the ground engaging surface is not continuous along a midfoot region of the sole structure.

In some embodiments, the supercritical fluid can be nitrogen. The super critical foam can be formed by pressurizing a mixture of the supercritical fluid (i.e., supercritical nitrogen) and a molten material of the cushioning member and then releasing the pressure to convert the supercritical fluid to a gas. The pressure can then be released to convert the supercritical fluid to a gas, which can cause the material to expand and foam, thereby forming the pockets of nitrogen gas therein.

According to yet another aspect, the present disclosure provides a sole structure for an article of footwear. The sole structure can include an outsole defining a ground-engaging surface, a first cushioning member, and a second cushioning member. The first cushioning member can be disposed between the outsole and the upper in a heel region of the sole structure and can include an anterior protrusion that extends into a midfoot region of the sole structure. The second cushioning member can be disposed between the outsole and the upper in a forefoot region of the sole structure and can include a posterior protrusion that extends into the midfoot region of sole structure. A toe end of the anterior protrusion can extend past a heel end of the posterior protrusion in a longitudinal direction so that the toe end of the anterior protrusion is positioned closer to the forefoot region than is the heel end of the posterior protrusion. A gap can extend between the first cushioning member and the second cushioning member from a lateral side of the sole structure to a medial side of the sole structure and least one of the first cushioning member or the second cushioning member can be a supercritical foam with pockets of nitrogen gas therein.

In some embodiments, the second cushioning member can include a longitudinal length defined by a length from a forefoot end of the second cushioning member to the heel end of the posterior protrusion, and the first cushioning member can include a longitudinal length defined by a length from the toe end of the anterior protrusion to a heel end of the first cushioning member. The longitudinal length of the second cushioning member can be greater than the longitudinal length of the first cushioning member.

In some embodiments, the posterior protrusion can be positioned along a medial half of the sole structure.

In some embodiments, the supercritical fluid can be nitrogen. The super critical foam can be formed by pressurizing a mixture of the supercritical fluid (i.e., supercritical nitrogen) and a molten material of the cushioning member and then releasing the pressure to convert the supercritical fluid to a gas. The pressure can then be released to convert the supercritical fluid to a gas, which can cause the material to expand and foam, thereby forming the pockets of nitrogen gas therein.

Other aspects of the article of footwear, including features and advantages thereof, will become apparent to one of ordinary skill in the art upon examination of the figures and detailed description herein. Therefore, all such aspects of the article of footwear are intended to be included in the detailed description and this summary.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **2** is a top, lateral side view of the sole structure of the article of footwear of FIG. **1**, the sole structure having a sole plate;

FIG. **3** is a lateral side view of the sole structure of FIG. **2**;

FIG. **4** is a bottom view of the sole structure of FIG. **2**;

FIG. **5** is a medial side view of the sole structure of FIG. **2**;

FIG. **6** is a cross-sectional view of the sole structure of FIG. **4** taken along line **6-6** thereof;

FIG. **7** is a top view of the sole structure of FIG. **2**;

FIG. **8** is a cross-sectional view of the sole structure of FIG. **4** taken along line **8-8** thereof;

FIG. **9** is a cross-sectional view of the sole structure of FIG. **4** taken along line **9-9** thereof;

FIG. **10** is a cross-sectional view of the sole structure of FIG. **4** taken along line **10-10** thereof;

FIG. **11** is a cross-sectional view of the sole structure of FIG. **4** taken along line **11-11** thereof;

FIG. **12** is a cross-sectional view of the sole structure of FIG. **4** taken along line **12-12** thereof;

FIG. **13** is an isometric view of the sole plate of the sole structure of FIG. **2**;

FIG. **14** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **15** is a top, lateral side view of the sole structure of the article of footwear of FIG. **14**, the sole structure having a sole plate;

FIG. **16** is a lateral side view of the sole structure of FIG. **15**;

FIG. **17** is a bottom view of the sole structure of FIG. **15**;

FIG. **18** is a medial side view of the sole structure of FIG. **15**;

FIG. **19** is a cross-sectional view of the sole structure of FIG. **17** taken along line **19-19** thereof;

FIG. **20** is a top view of the sole structure of FIG. **15**;

FIG. **21** is a cross-sectional view of the sole structure of FIG. **17** taken along line **21-21** thereof;

FIG. **22** is a cross-sectional view of the sole structure of FIG. **17** taken along line **22-22** thereof;

FIG. **23** is a cross-sectional view of the sole structure of FIG. **17** taken along line **23-23** thereof;

FIG. **24** is a cross-sectional view of the sole structure of FIG. **17** taken along line **24-24** thereof;

FIG. **25** is a cross-sectional view of the sole structure of FIG. **17** taken along line **25-25** thereof;

FIG. **26** is an isometric view of the sole plate of the sole structure of FIG. **15**;

FIG. **27** is a side view of the sole plate of FIG. **26**;

FIG. **28** is a top view of the sole plate of FIG. **26**;

FIG. **29** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to yet another embodiment of the disclosure;

FIG. **30** is a top, lateral side view of the sole structure of the article of footwear of FIG. **29**, the sole structure having a sole plate;

FIG. **31** is a lateral side view of the sole structure of FIG. **30**;

FIG. **32** is a bottom view of the sole structure of FIG. **30**;

FIG. **33** is a medial side view of the sole structure of FIG. **30**;

FIG. **34** is a cross-sectional view of the sole structure of FIG. **32** taken along line **34-34** thereof;

FIG. **35** is a top view of the sole structure of FIG. **30**;

FIG. **36** is a cross-sectional view of the sole structure of FIG. **32** taken along line **36-36** thereof;

FIG. **37** is a cross-sectional view of the sole structure of FIG. **32** taken along line **37-37** thereof;

FIG. **38** is a cross-sectional view of the sole structure of FIG. **32** taken along line **38-38** thereof;

FIG. **39** is a cross-sectional view of the sole structure of FIG. **32** taken along line **39-39** thereof;

FIG. **40** is a cross-sectional view of the sole structure of FIG. **32** taken along line **40-40** thereof;

FIG. **41** is an isometric view of the sole plate of the sole structure of FIG. **30**;

FIG. **42** is a side view of the sole plate of FIG. **41**;

FIG. **43** is a top view of the sole plate of FIG. **41**;

FIG. **44** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **45** is a top, lateral side view of the sole structure of the article of footwear of FIG. **44**, the sole structure having a sole plate;

FIG. **46** is a lateral side view of the sole structure of FIG. **45**;

FIG. **47** is a bottom view of the sole structure of FIG. **45**;

FIG. **48** is a medial side view of the sole structure of FIG. **45**;

FIG. **49** is a cross-sectional view of the sole structure of FIG. **47** taken along line **49-49** thereof;

FIG. **50** is a top view of the sole structure of FIG. **45**;

FIG. **51** is a cross-sectional view of the sole structure of FIG. **47** taken along line **51-51** thereof;

FIG. **52** is a cross-sectional view of the sole structure of FIG. **47** taken along line **52-52** thereof;

FIG. **53** is a cross-sectional view of the sole structure of FIG. **47** taken along line **53-53** thereof;

FIG. **54** is a cross-sectional view of the sole structure of FIG. **47** taken along line **54-54** thereof;

FIG. **55** is a cross-sectional view of the sole structure of FIG. **47** taken along line **55-55** thereof;

FIG. **56** is a lateral side view of an article of footwear configured as a left shoe that includes a sole structure, according to yet another embodiment of the disclosure;

FIG. **57** is a bottom view of the sole structure of FIG. **56**;

FIG. **58** is a medial side view of the sole structure of FIG. **56**;

FIG. **59** is a cross-sectional view of the sole structure of FIG. **57** taken along line **59-59** thereof;

FIG. **60** is a top view of the sole structure of FIG. **56**;

FIG. **61** is a cross-sectional view of the sole structure of FIG. **57** taken along line **61-61** thereof;

FIG. **62** is a cross-sectional view of the sole structure of FIG. **57** taken along line **62-62** thereof;

FIG. **63** is a cross-sectional view of the sole structure of FIG. **57** taken along line **63-63** thereof;

FIG. **64** is a cross-sectional view of the sole structure of FIG. **57** taken along line **64-64** thereof;

FIG. **65** is a cross-sectional view of the sole structure of FIG. **56** taken along line **65-65** thereof;

FIG. **66** is a lateral side view of an article of footwear configured as a left shoe that includes a sole structure, according to another embodiment of the disclosure;

FIG. **67** is a bottom view of the sole structure of FIG. **66**;

FIG. **68** is a medial side view of the sole structure of FIG. **66**;

FIG. **69** is a cross-sectional view of the sole structure of FIG. **67** taken along line **69-69** thereof;

FIG. **70** is a top view of the sole structure of FIG. **66**;

FIG. **71** is a cross-sectional view of the sole structure of FIG. **67** taken along line **71-71** thereof;

FIG. **72** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **73** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **74** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **75** is a cross-sectional view of the sole structure of FIG. **67** taken along line **72-72** thereof;

FIG. **76** is a lateral side view of an article of footwear configured as a left shoe that includes a sole structure, according to yet another embodiment of the disclosure;

FIG. **77** is a bottom view of the sole structure of FIG. **76**;

FIG. **78** is a medial side view of the sole structure of FIG. **76**;

FIG. **79** is a cross-sectional view of the sole structure of FIG. **77** taken along line **79-79** thereof;

FIG. **80** is a top view of the sole structure of FIG. **76**;

FIG. **81** is a cross-sectional view of the sole structure of FIG. **77** taken along line **81-81** thereof;

FIG. **82** is a cross-sectional view of the sole structure of FIG. **77** taken along line **81-81** thereof;

FIG. **83** is a cross-sectional view of the sole structure of FIG. **77** taken along line **82-82** thereof;

FIG. **84** is a cross-sectional view of the sole structure of FIG. **77** taken along line **83-83** thereof;

FIG. **85** is a cross-sectional view of the sole structure of FIG. **77** taken along line **84-84** thereof;

FIG. **86** is an isometric view of the sole plate for use with the sole structures of FIG. **56**, **66**, or **76**;

FIG. **87** is a top plan view of the sole plate of FIG. **86**;

FIG. **88** is an isometric view of another plate for use with the sole structures of FIGS. **66** and **76**;

FIG. **89** is a top plan view of the plate of FIG. **88**;

FIG. **90** schematically depicts a mean relative maximum oxygen uptake relative to a velocity of a runner, according to one or more aspects described herein;

FIG. **91** schematically depicts a mean heart rate relative to velocity of a runner, according to the aspects described herein;

FIG. **92** schematically depicts a mean rating of perceived exertion relative to a velocity of a runner, according to the aspects described herein;

FIG. **93** schematically depicts a mean lactate concentration relative to a velocity of a runner, according to the aspects described herein; and

FIG. **94** schematically depicts a regression analysis comparing a rate of feeling to a lactate concentration, according to the aspects described herein.

DETAILED DESCRIPTION OF THE DRAWINGS

The following discussion and accompanying figures disclose various embodiments or configurations of a shoe and a sole structure. Although embodiments of a shoe or sole structure are disclosed with reference to a sports shoe, such as a running shoe, tennis shoe, basketball shoe, etc., concepts associated with embodiments of the shoe or the sole structure may be applied to a wide range of footwear and footwear styles, including cross-training shoes, football shoes, golf shoes, hiking shoes, hiking boots, ski and snowboard boots, soccer shoes and cleats, walking shoes, and track cleats, for example. Concepts of the shoe or the sole structure may also be applied to articles of footwear that are considered non-athletic, including dress shoes, sandals, loafers, slippers, and heels. In addition to footwear, particular concepts described herein may also be applied and incorporated in other types of apparel or other athletic equipment, including helmets, padding or protective pads, shin guards, and gloves. Even further, particular concepts described herein may be incorporated in cushions, backpack straps, golf clubs, or other consumer or industrial products. Accordingly, concepts described herein may be utilized in a variety of products.

The term "about," as used herein, refers to variation in the numerical quantity that may occur, for example, through typical measuring and manufacturing procedures used for articles of footwear or other articles of manufacture that may include embodiments of the disclosure herein; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or mixtures or carry out the methods; and the like. Throughout the disclosure, the terms "about" and "approximately" refer to a range of values ±5% of the numeric value that the term precedes.

The terms "weight percent," "wt-%," "percent by weight," "% by weight," and variations thereof, as used herein, refer to the concentration of a substance or component as the weight of that substance or component divided by the total weight, for example, of the composition or of a particular component of the composition, and multiplied by 100. It is understood that, as used herein, "percent," "%," and the like may be synonymous with "weight percent" and "wt-%."

The present disclosure is directed to an article of footwear and/or specific components of the article of footwear, such as an upper and/or a sole or sole structure. The upper may comprise a knitted component, a woven textile, and/or a non-woven textile. The knitted component may be made by knitting of yarn, the woven textile by weaving of yarn, and the non-woven textile by manufacture of a unitary non-woven web. Knitted textiles include textiles formed by way of warp knitting, weft knitting, flat knitting, circular knitting, and/or other suitable knitting operations. The knit textile may have a plain knit structure, a mesh knit structure, and/or a rib knit structure, for example. Woven textiles include, but are not limited to, textiles formed by way of any of the numerous weave forms, such as plain weave, twill weave, satin weave, dobbin weave, jacquard weave, double weaves, and/or double cloth weaves, for example. Non-woven textiles include textiles made by air-laid and/or spun-laid methods, for example. The upper may comprise a variety of materials, such as a first yarn, a second yarn, and/or a third yarn, which may have varying properties or varying visual characteristics.

FIGS. **1-12** depict an exemplary embodiment of an article of footwear **100** including an upper **102** and a sole structure **104**. The upper **102** is attached to the sole structure **104** and together define an interior cavity into which a foot may be inserted. For reference, the article of footwear **100** defines a forefoot region **108**, a midfoot region **110**, and a heel region **112**. The forefoot region **108** generally corresponds with portions of the article of footwear **100** that encase portions of the foot that includes the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **110** is proximate and adjoining the forefoot region **108**, and generally corresponds with portions of the article of footwear **100** that encase the arch of foot, along with the bridge of the foot. The heel region **112** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

Many conventional footwear uppers are formed from multiple elements (e.g., textiles, polymer foam, polymer sheets, leather, and synthetic leather) that are joined through bonding or stitching at a seam. In some embodiments, the upper **102** of the article of footwear **100** is formed from a knitted structure or knitted components. In various embodiments, a knitted component may incorporate various types of yarn that may provide different properties to an upper. For example, one area of the upper **102** may be formed from a first type of yarn that imparts a first set of properties, and another area of the upper **102** may be formed from a second type of yarn that imparts a second set of properties. Using this configuration, properties of the upper **102** may vary

throughout the upper **102** by selecting specific yarns for different areas of the upper **102**.

The article of footwear **100** also includes a medial side **116** (e.g., see FIG. **3**) and a lateral side **118** (e.g., see FIG. **5**). In particular, the lateral side **118** corresponds to an outside portion of the article of footwear **100** and the medial side **116** corresponds to an inside portion of the article of footwear **100**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **116** are closest to one another when a user is wearing the articles of footwear **100**, while the lateral sides **118** are defined as the sides that are farthest from one another while being worn. The medial side **116** and the lateral side **118** adjoin one another at opposing, distal ends of the article of footwear **100**.

Unless otherwise specified, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** are intended to define boundaries or areas of the article of footwear **100**. To that end, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** generally characterize sections of the article of footwear **100**. Further, both the upper **102** and the sole structure **104** may be characterized as having portions within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**. Therefore, the upper **102** and the sole structure **104**, and/or individual portions of the upper **102** and the sole structure **104**, may include portions thereof that are disposed within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**.

The sole structure **104** is connected or secured to the upper **102** and extends between a foot of a user and the ground when the article of footwear **100** is worn by the user. The sole structure **104** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **104** of the present embodiment of the invention includes one or more components that provide the sole structure **104** with preferable spring and damping properties.

The sole structure **104** includes an outsole **130**, a first cushioning member **132**, a second cushioning member **134**, and a sole plate **136** (see FIG. **6**). The outsole **130** may define a bottom end or surface of the sole structure **104** across the heel region **112**, the midfoot region **110**, and the forefoot region **108**. Further, the outsole **130** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **104** and may be opposite of the insole thereof. The outsole **130** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **104**. In some embodiments, the outsole **130** may be formed from rubber, for example.

The first cushioning member **132** may be positioned adjacent to and on top of the outsole **130** in the heel region **112**, and positioned adjacent to and on top of the second cushioning member **134** in the midfoot region **110** and forefoot region **108**. The first cushioning member **132** may include one or more longitudinal grooves or flex lines **138** that extend between the medial side **116** and the lateral side **118**, which segments the first cushioning member **132** in the heel region **112**. For example, in the particular embodiment shown in FIGS. **1-12**, the first cushioning member **132** includes five flex lines **138**, which define four flex regions **140**. Further, as best shown in FIG. **4**, the flex lines **138** may have a sinusoidal shape between the medial side **116** and the lateral side **118**.

The second cushioning member **134** may be positioned adjacent to and on top of the outsole **130** in the midfoot region **110** and forefoot region **108**. As will be further discussed herein, the second cushioning member **134** may also be positioned between or be enclosed within the sole plate **136** in the midfoot region **110** and/or the forefoot region **108** (see FIG. **6**).

The first cushioning member **132** and/or the second cushioning member **134** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **132** and/or the second cushioning member **134** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **132** and/or the second cushioning member **134** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **132** and/or the second cushioning member **134** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **132** and, more preferably, the second cushioning member **134**. In further embodiments, the first cushioning member **132** and/or the second cushioning member **134** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **132** and/or the second cushioning member **134** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **104** further includes the sole plate **136**, which as best shown in FIG. **13**, includes an upper flange **150** and a lower flange **152** and an arched, curved, or C-shaped rear portion **154** that connects the upper flange **150** and the lower flange **152**. Further, a gap **156** extends between the upper flange **150** and the lower flange **152**, into which the second cushioning member **134** may be positioned, as previously discussed herein. As shown in FIG. **6**,

the sole plate **136** extends at least partially through the midfoot region **110** and at least partially through the forefoot region **108**. As further illustrated in FIG. **6**, the rear portion **154** of the sole plate **136** may be spaced from a rear side of the second cushioning member **134**, which creates a spacing **158** therebetween.

With continued reference to FIG. **6**, the lower flange **152** may be adjacent to and positioned between the outsole **130** and the second cushioning member **134**, and the upper flange **150** may be adjacent to and positioned between the second cushioning member **134** and the first cushioning member **132**. In some embodiments, the sole plate **136** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **136** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **136** can include carbon fiber, for example.

In some embodiments, the outsole **130** or the ground-engaging surface is not continuous along the article of footwear **100**. For example, as best shown in FIG. **6**, there is a spacing **158**, or an absence of a ground-engaging surface, along the article of footwear **100**, which is located within the midfoot region **110** of the article of footwear **100**.

FIGS. **14-25** show another configuration of an article of footwear **200**. Similar to the sole structure **104**, the sole structure **204** is configured to be attached to an upper **202** and together define an interior cavity into which a foot may be inserted. For reference, the sole structure **204** defines a forefoot region **208**, a midfoot region **210**, and a heel region **212**. The forefoot region **208** generally corresponds with portions of an article of footwear, such as the article of footwear **200**, for example, that encase portions of the foot that include the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **210** is proximate and adjoining the forefoot region **208**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **212** is proximate and adjoining the midfoot region **210** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

The article of footwear **200** also includes a medial side **216** (e.g., see FIG. **18**) and a lateral side **218** (e.g., see FIG. **16**). In particular, the lateral side **218** corresponds to an outside portion of the article of footwear **200** and the medial side **216** corresponds to an inside portion of the article of footwear **200**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **216** are closest to one another when a user is wearing the articles of footwear **200**, while the lateral sides **218** are defined as the sides that are farthest from one another while being worn. The medial side **216** and the lateral side **218** adjoin one another at opposing, distal ends of the article of footwear **200**.

Unless otherwise specified, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** are intended to define boundaries or areas of the article of footwear **200**. To that end, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** generally characterize sections of the article of footwear **200**. Further, both the upper **202** and the sole structure **204** may be characterized as having portions within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**. Therefore, the upper **202** and the sole structure **204**, and/or individual portions of the upper **202** and the sole structure **204**, may include portions thereof that are disposed within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**.

The sole structure **204** is connected or secured to the upper **202** and extends between a foot of a user and the ground when the article of footwear **200** is worn by the user. The sole structure **204** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **204** of the present embodiment of the invention includes one or more components that provide the sole structure **204** with preferable spring and damping properties.

The sole structure **204** includes an outsole **230**, a first cushioning member **232**, a second cushioning member **234**, and a sole plate **236** (see FIG. **19**). The outsole **230** may define a bottom end or surface of the sole structure **204** across the heel region **212**, the midfoot region **210**, and the forefoot region **208**. Further, the outsole **230** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **204** and may be opposite of the insole thereof. The outsole **230** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **204**. In some embodiments, the outsole **230** may be formed from rubber, for example.

The first cushioning member **232** may be positioned adjacent to and on top of the outsole **230** in the heel region **212**, and positioned adjacent to and on top of the second cushioning member **234** in the midfoot region **210** and forefoot region **208**. The first cushioning member **232** may include one or more longitudinal grooves or flex lines **238** that extend between the medial side **216** and the lateral side **218**, which segments the first cushioning member **232** in the heel region **212**. For example, in the particular embodiment shown in FIGS. **14-25**, the first cushioning member **232** includes five flex lines **238**, which define four flex regions **240**. Further, as best shown in FIG. **17**, the flex lines **238** may have a sinusoidal shape between the medial side **216** and the lateral side **218**.

The second cushioning member **234** may be positioned adjacent to and on top of the outsole **230** in the midfoot region **210** and forefoot region **208**. As will be further discussed herein, the second cushioning member **234** may also be positioned between or be enclosed within the sole plate **236** in the forefoot region **208** (see FIG. **19**).

The first cushioning member **232** and/or the second cushioning member **234** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **232** and/or the second cushioning member **234** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **232** and/or the second cushioning

member **234** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **232** and/or the second cushioning member **234** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **232** and, more preferably, the second cushioning member **234**. In further embodiments, the first cushioning member **232** and/or the second cushioning member **234** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **232** and/or the second cushioning member **234** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **204** further includes the sole plate **236**, which is best shown in FIGS. **26-28**, includes an upper flange **250** and a lower flange **252** that connect at a vertex point **254**. Further, a gap **256** extends between the upper flange **250** and the lower flange **252**, into which the second cushioning member **234** may be positioned, as previously discussed herein. As shown in FIG. **19**, the sole plate **236** extends through the forefoot region **208**. As further illustrated in FIG. **19**, the vertex point **254** may be spaced from a front side of the second cushioning member **234**, which creates a spacing or gap **258** between the upper flange **250** and the lower flange **252**.

With continued reference to FIG. **19**, a rear portion of the lower flange **252** may be adjacent to and positioned between the outsole **230** and the second cushioning member **234**, and a rear portion of the upper flange **250** may be adjacent to and positioned between the second cushioning member **234** and the first cushioning member **232**. In some embodiments, the sole plate **236** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

With reference to FIGS. **26** and **28**, the upper flange **250** and the lower flange **252** may also include one or more cut-out portions **260**, **262**. The cut-out portions **260**, **262** may be advantageous to allow the medial and lateral sides of the sole plate **236** to flex independent of one another.

In some embodiments, the sole plate **236** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **236** can include carbon fiber, for example.

In some embodiments, the outsole **230** or the ground-engaging surface is not continuous along the article of footwear **200**. For example, as best shown in FIG. **19**, there is a spacing **264**, or an absence of a ground-engaging surface, along the article of footwear **200**, which is located within the midfoot region **210** of the article of footwear **200**.

FIGS. **29-40** show another configuration of an article of footwear **300**. Similar to the sole structures **104**, **204**, the sole structure **304** is configured to be attached to an upper **302** and together define an interior cavity into which a foot may be inserted. For reference, the sole structure **304** defines a forefoot region **308**, a midfoot region **310**, and a heel region **312**. The forefoot region **308** generally corresponds with portions of an article of footwear, such as the article of footwear **300**, for example, that encase portions of the foot that include the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **310** is proximate and adjoining the forefoot region **308**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **312** is proximate and adjoining the midfoot region **310** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

The article of footwear **300** also includes a medial side **316** (e.g., see FIG. **33**) and a lateral side **318** (e.g., see FIG. **31**). In particular, the lateral side **318** corresponds to an outside portion of the article of footwear **300** and the medial side **316** corresponds to an inside portion of the article of footwear **300**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **316** are closest to one another when a user is wearing the articles of footwear **300**, while the lateral sides **318** are defined as the sides that are farthest from one another while being worn. The medial side **316** and the lateral side **318** adjoin one another at opposing, distal ends of the article of footwear **300**.

Unless otherwise specified, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** are intended to define boundaries or areas of the article of footwear **300**. To that end, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** generally characterize sections of the article of footwear **300**. Further, both the upper **302** and the sole structure **304** may be characterized as having portions within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**. Therefore, the upper **302** and the sole structure **304**, and/or individual portions of the upper **302** and the sole structure **304**, may include portions thereof that are disposed within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**.

The sole structure **304** is connected or secured to the upper **302** and extends between a foot of a user and the ground when the article of footwear **300** is worn by the user. The sole structure **304** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **304** of the present embodiment of the invention includes one

or more components that provide the sole structure **304** with preferable spring and damping properties.

The sole structure **304** includes an outsole **330**, a first cushioning member **332**, a second cushioning member **334**, and a sole plate **336** (see FIG. **34**). The outsole **330** may define a bottom end or surface of the sole structure **304** across the heel region **312**, the midfoot region **310**, and the forefoot region **308**. Further, the outsole **330** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **304** and may be opposite of the insole thereof. The outsole **330** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **304**. In some embodiments, the outsole **330** may be formed from rubber, for example.

The first cushioning member **332** may be positioned adjacent to and on top of the outsole **330** in the heel region **312**. The first cushioning member **332** may also be positioned adjacent to and below the sole plate **336**. The first cushioning member **332** may include one or more longitudinal grooves or flex lines **338** that extend between the medial side **316** and the lateral side **318**, which segments the first cushioning member **332** in the heel region **312**. For example, in the particular embodiment shown in FIGS. **29-40**, the first cushioning member **332** includes five flex lines **338**, which define four flex regions **340**. Further, as best shown in FIG. **32**, the flex lines **338** may have a sinusoidal shape between the medial side **316** and the lateral side **318**.

The second cushioning member **334** may be positioned adjacent to and on top of the outsole **330** in the midfoot region **310** and forefoot region **308**. As will be further discussed herein, the sole plate **336** may also bifurcate the second cushioning member **334**, such that the sole plate **336** is positioned within the second cushioning member **334** (see FIG. **34**).

The first cushioning member **332** and/or the second cushioning member **334** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **332** and/or the second cushioning member **334** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **332** and/or the second cushioning member **334** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **332** and/or the second cushioning member **334** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **332** and, more preferably, the second cushioning member **334**. In further embodiments, the first cushioning member **332** and/or the second cushioning member **334** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **332** and/or the second cushioning member **334** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **304** further includes the sole plate **336**, which as best shown in FIGS. **41-43**, includes a curved portion **350** and a rear portion **352**, which may be relatively planar. The curved portion **350** may also include an anterior curved portion **354** and a posterior curved portion **356**. The anterior curved portion **354** and the posterior curved portion **356** may each individually include one or more radii of curvature.

With reference to FIG. **34**, the curved portion **350** of the plate **336** may be positioned within the second cushioning member **334** and the rear portion **352** of the plate **336** may be positioned above the first cushioning member **332**. Further, a portion of the posterior curved portion **356** may extend between a gap **358** between the first cushioning member **332** and the second cushioning member **334**. Resultantly, in this embodiment, a portion of the plate **336** does not include a cushioning member—such as the first cushioning member **332** or the second cushioning member **334**—above, below, or between the plate **336**. Thus, the plate **336** is spaced from the upper **302** and a gap, or absence of material, is present between the plate **336** and the upper **302** approximate the midfoot region **310** and/or the heel region **312** (see FIG. **29**). In some embodiments, the sole plate **336** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **336** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **336** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **330** or the ground-engaging surface is not continuous along the article of footwear **300**. For example, as best shown in FIG. **34**, there is a spacing or gap **358**, or an absence of a ground-engaging surface, along the article of footwear **300**, which is located within the midfoot region **310** of the article of footwear **300**.

FIGS. **44-55** show another configuration of an article of footwear **400**. Similar to the sole structures **104**, **204**, **304**, the sole structure **404** is configured to be attached to an upper **402** and together define an interior cavity into which a foot may be inserted. Like the other sole structures, the sole structure **404** can be defined by a forefoot region **408**, a midfoot region **410**, a heel region **412**, as well as a medial side **416** (see FIG. **48**) and a lateral side **418** (see FIG. **46**). Like the other embodiments described herein, unless otherwise specified, the forefoot region, the midfoot region, the heel region, the medial side **416**, and the lateral side **418** are intended to define boundaries or areas of the article of footwear **400**. To that end, the forefoot region, the midfoot

region, the heel region, the medial side **416**, and the lateral side **418** generally characterize sections of the article of footwear **400**. Further, both the upper **402** and the sole structure **404** may be characterized as having portions within the forefoot region **408**, the midfoot region **410**, the heel region **412**, and on the medial side **416** and the lateral side **418**. Therefore, the upper **402** and the sole structure **404**, and/or individual portions of the upper **402** and the sole structure **404**, may include portions thereof that are disposed within the forefoot region **408**, the midfoot region **410**, the heel region **412**, and on the medial side **416** and the lateral side **418**.

The sole structure **404** is connected or secured to the upper **402** and extends between a foot of a user and the ground when the article of footwear **400** is worn by the user. The sole structure **404** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system, and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **404** of the present embodiment of the invention includes one or more components that provide the sole structure **404** with preferable spring and damping properties.

The sole structure **404** includes an outsole **430**, a first cushioning member **432**, a second cushioning member **434**, and a sole plate **436** (see FIG. **49**). The outsole **430** may define a bottom end or surface of the sole structure **404** across the heel region **412**, the midfoot region **410**, and the forefoot region **408**. Further, the outsole **430** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **404** and may be opposite of the insole thereof. The outsole **430** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **404**. In some embodiments, the outsole **430** may be formed from rubber, for example.

The first cushioning member **432** may be positioned adjacent to and on top of the outsole **430** in the heel region **412**, and positioned adjacent to and on top of the second cushioning member **434** in the midfoot region **410** and forefoot region **408**. The first cushioning member **432** may include one or more longitudinal grooves or flex lines **438** that extend between the medial side **416** and the lateral side **418**, which segments the first cushioning member **432** in the heel region **412**. For example, in the particular embodiment shown in FIGS. **44-55**, the first cushioning member **432** includes five flex lines **438**, which define four flex regions **440**. Further, as best shown in FIG. **47**, the flex lines **438** may have a sinusoidal shape between the medial side **416** and the lateral side **418**.

The second cushioning member **434** may be positioned adjacent to and on top of the outsole **430** in the midfoot region **410** and forefoot region **408**. As will be further discussed herein, the second cushioning member **434** may also be positioned between or be enclosed within the sole plate **436** in the forefoot region **408** (see FIG. **49**).

The first cushioning member **432** and/or the second cushioning member **434** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **432** and/or the second cushioning member **434** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **432** and/or the second cushioning member **434** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the first cushioning member **432** and/or the second cushioning member **434** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. During an exemplary process, a solution of supercritical fluid and molten material is pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the first cushioning member **432** and, more preferably, the second cushioning member **434**. In further embodiments, the first cushioning member **432** and/or the second cushioning member **434** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the first cushioning member **432** and/or the second cushioning member **434** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape.

The sole structure **404** further includes the sole plate **436**, which as best shown in FIGS. **49** and **50**, is a relatively planar structure having a first cut-out portion **450** near a front end thereof and a second cut-out portion **452** near a rear end thereof.

With particular reference to FIG. **49**, the plate **436** may be positioned above the first cushioning member **432** in the midfoot region **410**. In some embodiments, the sole plate **436** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.8 centimeters.

In some embodiments, the sole plate **436** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **436** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **430** or the ground-engaging surface is not continuous along the article of footwear **400**. For example, as best shown in FIG. **49**, there is a spacing or gap **458**, or an absence of a ground-engaging surface, along the article of footwear **400**, which is located within the midfoot region **410** of the article of footwear **400**.

FIGS. **56-65** show another configuration of an article of footwear **500** having an upper **502** and a sole structure **504**. Similar to the sole structures **104**, **204**, **304**, **404**, the sole structure **504** is configured to be attached to the upper **502**

and together define an interior cavity into which a foot may be inserted. Also similar to the other sole structures, the sole structure **504** includes a forefoot region **508**, a midfoot region **510**, a heel region **512**, a medial side **516** (see FIG. **58**) and a lateral side **518** (see FIG. **56**). Unless otherwise specified, the forefoot region **508**, the midfoot region **510**, the heel region **512**, the medial side **516**, and the lateral side **518** are intended to define boundaries or areas of the article of footwear **500**. Further, as will be further discussed herein, the sole structure **504** of the present embodiment of the invention includes one or more components that provide the sole structure **504** with preferable spring and damping properties.

The sole structure **504** also includes an outsole **530**, a first cushioning member **532**, a second cushioning member **534**, and a sole plate **536** (see FIG. **59**). The first cushioning member **532** may be positioned adjacent to and on top of the outsole **530** in the heel region **512**. The first cushioning member **532** may also be positioned adjacent to and below the sole plate **536**. The first cushioning member **532** may include one or more longitudinal grooves or flex lines **538** that extend between the medial side **516** and the lateral side **518**, which segments the first cushioning member **532** in the heel region **512**.

The second cushioning member **534** may be positioned adjacent to and on top of the outsole **530** in the midfoot region **510** and forefoot region **508**. As will be further discussed herein, the sole plate **536** may also extend between the second cushioning member **534** and the outsole **530** (see FIG. **59**). The first cushioning member **532** and/or the second cushioning member **534** may be individually constructed from a thermoplastic material, such as polyurethane (PU), for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the first cushioning member **532** and/or the second cushioning member **534** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first cushioning member **532** and/or the second cushioning member **534** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

The sole structure **504** further includes the sole plate **536**, which as best shown in FIG. **59**, includes a curved portion **550** and a rear portion **552**, which may be relatively planar. The curved portion **550** may also include an anterior curved portion **554** and a posterior curved portion **556**. The anterior curved portion **554** and the posterior curved portion **556** may each individually include one or more radii of curvature.

With reference to FIG. **59**, the curved portion **550** of the plate **536** may be positioned below the second cushioning member **534** and the rear portion **552** of the plate **536** may be positioned above the first cushioning member **532**. Further, a portion of the posterior curved portion **556** may extend between a gap **558** between the first cushioning member **532** and the second cushioning member **534**. In some embodiments, the sole plate **536** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters. In some embodiments, the sole plate **536** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are

also possible. In other embodiments, the sole plate **536** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **530** or the ground-engaging surface is not continuous along the article of footwear **500**. For example, as best shown in FIG. **59**, there is a spacing or gap **558**, or an absence of a ground-engaging surface, along the article of footwear **500**, which is located within the midfoot region **510** and/or the heel region **512** of the article of footwear **500**. In this embodiment, similar to the plate **336**, a portion of the plate **536** does not include a cushioning member—such as the first cushioning member **532** or the second cushioning member **534**—above, below, or between the plate **536**. Thus, the plate **536** is spaced from the upper **502** and a gap, or absence of material, is present between the plate **536** and the upper **502** approximate the midfoot region **510** and/or the heel region **512** (see FIG. **59**).

In some embodiments, the sole structure **504** may also include a second plate **560**. In the particular embodiment shown in FIGS. **56-65**, the second plate **560** encases the sole plate **536** such that the sole plate **536** sits within the second plate **560**. Additionally, as best shown in FIG. **59**, the second plate **560** extends across the forefoot region **508**, the midfoot region **510**, and the heel region **512**. Thus, the second plate **560** is positioned below the sole plate **536** across an entire length thereof. In other embodiments, as will be further discussed herein, the second plate **560** may only extend across a portion of the sole plate **536** and may be positioned at a location along the sole structure **504** where the sole plate **536** needs targeted structural support. The second plate **560** may be constructed from similar materials to the sole plate **536**, which have already been discussed herein. However, in particular embodiments, the material used to construct the second plate **560** may also differ from the material used to construct the sole plate **536** such that the second plate **560** provides added reinforcement to the sole plate **536**. For example, in one embodiment, the sole plate **536** may be constructed from a carbon fiber material and the second plate **560** may be constructed from thermoplastic polyurethane (TPU) to support the sole plate **536**. Additionally, the second plate **560** may support the structural integrity of the sole plate **536** and prevent the sole plate **536** from fracturing during use thereof.

In addition to the second plate **560**, an amount of material may be injected into one or more grooves of the sole plate **536**. More particularly, in this embodiment, the sole plate **536** may include two grooves **562** (see FIG. **63**) and a material **564** may be injected or positioned within the grooves **562**. Similar to the second plate **560**, the material injected into the grooves **562** may provide further structural support to the sole plate **536** and targeted support to the sole plate **536**. For example, in this particular embodiment, the grooves are provided across the midfoot or arch region of the sole structure **504**, and therefore, the material **564** may provide support to the sole plate **536** in the arch region thereof, which thereby provides further support to a user's foot in the arch region of the sole structure **504**. The injected material **564** may be a suitable plastic material, such as thermoplastic polyurethane (TPU) or the like.

FIGS. **66-75** show another configuration of an article of footwear **600** having an upper **602** and a sole structure **604**. Similar to the sole structures **104**, **204**, **304**, **404**, **504** the sole structure **604** is configured to be attached to the upper **602** and together define an interior cavity into which a foot may be inserted. The sole structure **604**, similar to the other sole structures, includes a forefoot region **608**, a midfoot region **610**, a heel region **612**, a medial side **616** (see FIG. **68**) and

a lateral side **618** (see FIG. **66**). Unless otherwise specified, the forefoot region **608**, the midfoot region **610**, the heel region **612**, the medial side **616**, and the lateral side **618** are intended to define boundaries or areas of the article of footwear **600**.

The sole structure **604** also includes an outsole **630**, a first cushioning member **632**, a second cushioning member **634**, and a sole plate **636** (see FIG. **69**). The outsole **630** may define a bottom end or surface of the sole structure **604** across the heel region **612**, the midfoot region **610**, and the forefoot region **608**.

The first cushioning member **632** may be positioned adjacent to and on top of the outsole **630** in the heel region **612**. The first cushioning member **632** may also be positioned adjacent to and below the sole plate **636**. The first cushioning member **632** may include one or more longitudinal grooves or flex lines **638** that extend between the medial side **616** and the lateral side **618**, which segments the first cushioning member **632** in the heel region **612**.

The second cushioning member **634** may be positioned adjacent to and on top of the outsole **630** in the midfoot region **610** and forefoot region **608**. As will be further discussed herein, the sole plate **636** may also bifurcate the second cushioning member **634**, such that the sole plate **636** is positioned within the second cushioning member **634** (see FIG. **69**).

The first cushioning member **632** and/or the second cushioning member **634** may be individually constructed from similar materials to those already disclosed in connection with the other embodiments disclosed herein.

The sole structure **604** further includes the sole plate **636**, which as best shown in FIGS. **69**, includes a curved portion **650** and a rear portion **652**, which may be relatively planar. The curved portion **650** may also include an anterior curved portion **654** and a posterior curved portion **656**. The anterior curved portion **654** and the posterior curved portion **656** may each individually include one or more radii of curvature.

With reference to FIG. **69**, the curved portion **650** of the plate **636** may be positioned within the second cushioning member **634** and the rear portion **652** of the plate **636** may be positioned above the first cushioning member **632**. Further, a portion of the posterior curved portion **656** may extend between a gap **658** between the first cushioning member **632** and the second cushioning member **634**. In some embodiments, the sole plate **636** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **636** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **636** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **630** or the ground-engaging surface is not continuous along the article of footwear **600**. For example, as best shown in FIG. **69**, there is a spacing or gap **658**, or an absence of a ground-engaging surface, along the article of footwear **600**, which is located within the midfoot region **610** of the article of footwear **600**.

Similar to the sole structure **504**, the sole structure **604** may also include a second plate **660**. In the particular embodiment shown in FIGS. **66-75**, the second plate **660** partially encases the sole plate **636** such that the sole plate **636** sits within the second plate **660**. Additionally, as best shown in FIG. **69**, the second plate **660** extends across the midfoot region **610** and the heel region **610**. Thus, the second plate **660** is positioned below the sole plate **636** across a portion of the sole plate **636**, and more particularly, the arch or midfoot region thereof. In other embodiments, as previously discussed herein, the second plate **660** may extend across an entire length of the sole plate **636** or may be positioned at a location along the sole structure **604** where the sole plate **636** needs targeted structural support. The second plate **660** may be constructed from similar materials to the sole plate **636**, which have already been discussed herein. However, in particular embodiments, the material used to construct the second plate **660** may differ from the material used to construct the sole plate **636** such that the second plate **660** provides added reinforcement to the sole plate **636**. For example, in one embodiment, the sole plate **636** may be constructed from a carbon fiber material and the second plate **660** may be constructed from thermoplastic polyurethane (TPU) to support the sole plate **636**. Additionally, the second plate **660** may support the structural integrity of the sole plate **636** and prevent the sole plate **636** from fracturing during use thereof.

In addition to the second plate **660**, an amount of material may be injected into one or more grooves of the sole plate **636**. More particularly, in this embodiment, the sole plate **636** may include two grooves **662** (see FIG. **73**) and material **664** may be injected or positioned within the grooves **662**. Similar to the second plate **660**, the material injected into the grooves **662** may provide further structural support to the sole plate **636** and targeted support to the sole plate **636**. For example, in this particular embodiment, the grooves are provided across the midfoot or arch region of the sole structure **604**, and therefore, the material **664** may provide support to the sole plate **636** in the arch region thereof, which thereby provides further support to a user's foot in the arch region of the sole structure **604**. The injected material **664** may be a suitable plastic material, such as thermoplastic polyurethane (TPU) or the like.

FIGS. **76-85** show another configuration of an article of footwear **700** having an upper **702** and a sole structure **704**. Similar to the sole structures **104**, **204**, **304**, **404**, **504**, **604** the sole structure **704** is configured to be attached to the upper **702** and together define an interior cavity into which a foot may be inserted. Further, the sole structure **704** includes a forefoot region **708**, a midfoot region **710**, a heel region **712**, a medial side **716** (see FIG. **78**), and a lateral side **718** (see FIG. **76**). Unless otherwise specified, the forefoot region **708**, the midfoot region **710**, the heel region **712**, the medial side **716**, and the lateral side **718** are intended to define boundaries or areas of the article of footwear **700**.

The sole structure **704** includes an outsole **730**, a first cushioning member **732**, a second cushioning member **734**, and a sole plate **736** (see FIG. **79**). The outsole **730** may define a bottom end or surface of the sole structure **704** across the heel region **712**, the midfoot region **710**, and the forefoot region **708**.

The first cushioning member **732** may be positioned adjacent to and on top of the outsole **730** in the heel region **712**. The first cushioning member **732** may also be positioned adjacent to and below the sole plate **736**. The first cushioning member **732** may include one or more longitudinal grooves or flex lines **738** that extend between the medial side **716** and the lateral side **718**, which segments the first cushioning member **732** in the heel region **712**. As illustrated, the flex lines **738** are curvilinear lines; however, they may also be configured differently, for example to be linear or arcuate. In some cases, flex lines can also be oriented differently, for example to extend in a longitudinal,

i.e., heel-to-toe, direction. The flex lines **738** can segment the first cushioning member **732** in the heel region **712**. For example, as shown in FIGS. **77** and **79**, the first cushioning member **732** includes two flex lines **738**, which define three flex regions **740**, i.e., flex zones. Specifically, the first cushioning member **732** includes a first or toe end flex region, a second or middle flex region, and a third or heel end flex region. Further, as best shown in FIG. **77**, the flex lines **738** are configured as non-linear lines with a sinusoidal shape, which extend between the medial side **716** and the lateral side **718**.

The second cushioning member **734** may be positioned adjacent to and on top of the outsole **730** in the midfoot region **710** and forefoot region **708**. As will be further discussed herein, the sole plate **736** may also bifurcate the second cushioning member **734**, such that the sole plate **736** is positioned within the second cushioning member **734** (see FIG. **79**). Further, the sole plate **736** may also bifurcate the first cushioning member **732**, such that the sole plate **736** is positioned within the first cushioning member as well (see FIG. **79**).

The first cushioning member **732** and/or the second cushioning member **734** may be individually constructed from similar materials to the first and second cushioning members of the other embodiments.

The sole structure **704** also includes the sole plate **736**, which as best shown in FIG. **79**, includes a curved portion **750** and a rear portion **752**, which may be relatively planar. The curved portion **750** may also include an anterior curved portion **754** and a posterior curved portion **756**. The anterior curved portion **754** and the posterior curved portion **756** may each individually include one or more radii of curvature.

With reference to FIG. **79**, the curved portion **750** of the plate **736** may be positioned within the second cushioning member **734** and the rear portion **752** of the plate **736** may be positioned above the first cushioning member **732**. Further, a portion of the posterior curved portion **756** may extend between a gap **758** between the first cushioning member **732** and the second cushioning member **734**. In some embodiments, the sole plate **736** has a uniform thickness. For example, in particular embodiments, the thickness is approximately 1.2 centimeters.

In some embodiments, the sole plate **736** comprises a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the sole plate **736** can include carbon fiber, for example.

As briefly noted herein, in some embodiments, the outsole **730** or the ground-engaging surface is not continuous along the article of footwear **700**. For example, as best shown in FIG. **79**, there is a spacing or gap **758**, or an absence of a ground-engaging surface, along the article of footwear **700**, which is located within the midfoot region **710** of the article of footwear **700**. Correspondingly, the outsole **730** can include a first outsole portion **780** coupled to the first cushioning member **732** and a second outsole portion **782** coupled to the second cushioning member **734**. In some cases, each of the first outsole portion **780** and the second outsole portion **782** can further include one or more sub-portions. For example, as illustrated in FIG. **77**, the first outsole portion includes three heel outsole portions **784**, e.g., a first outsole element, a second outsole element, and a third outsole element, each coupled to one of the respective flex regions **740**. Accordingly, the outsole portions **784** are separated from one another, such that the flex lines **738** extend between the respective outsole portions **784**, and such that the ground engaging surface is not continuous in the heel region **712**.

Further, since the first cushioning member **732** and the second cushioning member **734** are separated by the gap **758**, a bottom surface **703** of the upper **702** can be exposed, such that the bottom surface **703** is visible when viewed in a direction going from the bottom surface of the sole structure **704** toward the upper **702** (see FIG. **77**). Here, due to the inclusion of the sole plate **736**, the bottom surface **703** is exposed along the medial side **716** and the lateral side **718** of the sole structure **704**. However, the bottom surface **703** also remains exposed between the sole plate **736** and the upper **702** as a result of the gap that is maintained therebetween.

Continuing, as illustrated in FIG. **77**, the gap **758** can extend along a path between the medial side **716** and the lateral side **718** of the sole structure **704**. Depending on the specific shapes of the first cushioning member **732** and the second cushioning member **734**, the gap **758** can follow a number of linear or non-linear paths between the first cushioning member **732** and the second cushioning member **734**. For example, as illustrated in FIG. **77**, the first cushioning member **732** has a U-shaped distal end **788** positioned at a toe end of the first cushioning member **732**. The U-shaped distal end **788** is formed by one or more anterior protrusions **790** that extend from the distal end **788** of the first cushioning member **732** toward the second cushioning member **734** (e.g., at each of the medial side **716** and the lateral side **718**). Here the first cushioning member **732** includes two anterior protrusions **790** that extend from each of the medial side **716** and the lateral side **718** of the first cushioning member **732** to define a notch **792** therebetween. The anterior protrusions **790** extend at least partially into the midfoot region **710** of the sole structure to define respective distal ends **791** that terminate within the midfoot region **710**. The second cushioning member defines a rounded distal end **794** at a heel end of the second cushioning member **734**, which is formed by a posterior protrusion **796** that extends toward the first cushioning member **732** and at least partially into the midfoot region **710**. More specifically, the posterior protrusion **796** can extend toward the notch **792** in the midfoot region **710** and along a medial half of the sole structure **704**. As a result, the gap **758** extends along a non-linear path **759** that is substantially U-shaped.

In some cases, the posterior protrusion **796** can extend past at least one of the anterior protrusions **790** to extend into the notch **792**, such that the U-shaped distal end **788** of the first cushioning member **732** wraps at least partially around the distal end **794** of the second cushioning member **734** (i.e., a distal end of the posterior protrusion **796**). Consequently, one or both of the anterior protrusions **790** can extend past the posterior protrusion **796** in the midfoot region **710** so that a distal end **791** (i.e., a toe end) of at least one of the anterior protrusions **790** is disposed closer to a toe end of the sole structure **704** than is a distal end **795** (i.e., a heel end) of the posterior protrusion **796**. Put another way, the first cushioning member **732** can extend past the second cushioning member **734** in a longitudinal direction so that a portion of the first cushioning member **732** (e.g., the distal end **788**) is closer to the toe end of the sole structure **704** than is a portion of the second cushioning member **734** (e.g., the distal end **794**).

Additionally, each of the first cushioning member **732** and the second cushioning member **734** can define a respective longitudinal length between a forefoot end (i.e., a toe end) and a heel end. More specifically, as illustrated in FIG. **77**,

the first cushioning member **732** defines a longitudinal length **720** defined by a length from a forefoot end (e.g., a distal end **791** of an anterior protrusion **790**) to a heel end **797** (e.g., a heel end of the sole structure **704**), and the second cushioning member **734** defines a longitudinal length **722** defined by a length from a forefoot end **798** and a heel end (e.g., the distal end **795** of the posterior protrusion **796**). Here, the longitudinal length **722** of the second cushioning member **734** is greater than the longitudinal length **720** of the first cushioning member **732**.

Similar to the sole structures **504**, **604**, the sole structure **704** may also include a second plate **760**. In the particular embodiment shown in FIGS. **76-85**, the second plate **760** partially encases the sole plate **736** such that the sole plate **736** sits within the second plate **760**. Additionally, as best shown in FIG. **79**, the second plate **760** extends across the midfoot region **710** and the heel region **712**. Thus, the second plate **760** is only positioned below the sole plate **736** across a portion of the sole plate **736**, and more particularly, the arch or midfoot region thereof. In other embodiments, as previously discussed herein, the second plate **760** may extend across an entire length of the sole plate **736** or may be positioned at a location along the sole structure **704** where the sole plate **736** needs targeted structural support. The second plate **760** may be constructed from similar materials to the sole plate **736**, which have already be discussed herein. However, in particular embodiments, the material used to construct the second plate **760** may differ from the material used to construct the sole plate **736** such that the second plate **760** provides added reinforcement to the sole plate **736**. For example, in one embodiment, the sole plate **736** may be constructed from a carbon fiber material and the second plate **760** may be constructed from thermoplastic polyurethane (TPU) to support the sole plate **736**. Additionally, the second plate **760** may support the structural integrity of the sole plate **736** and prevent the sole plate **736** from fracturing during use thereof.

In addition to the second plate **760**, an amount of material may be injected into one or more grooves of the sole plate **736**. More particularly, in this embodiment, the sole plate **736** may include two grooves **762** formed from a plurality of raised portions **764** (see FIGS. **83**, **86**, and **87**), and material **766** may be injected or positioned within the grooves **762**. Similar to the second plate **760**, the material injected into the grooves **762** may provide further structural support to the sole plate **736** and targeted support to the sole plate **736**. For example, in this particular embodiment, the grooves are provided across the midfoot or arch region of the sole structure **704**, and therefore, the material **766** may provide support to the sole plate **736** in the arch region thereof, which thereby provides further support to a user's foot in the arch region of the sole structure **704**. The injected material **766** may be a suitable plastic material, such as thermoplastic polyurethane (TPU) or the like.

FIGS. **88** and **89** depict the second plate **760** of the present embodiment. Further, as discussed herein in connection with several embodiments, the second plates **560**, **660**, **760** may encase the sole plates **536**, **636**, **736**. To perform this function, the second plate **560**, **660**, **760** may include outer walls or sidewalls **570**, **670**, **770** that extend upward from the main body of the second plate **560**, **660**, **760**. Additionally, the second plate **560**, **660**, **760** may include a shape that conforms to the shape of the sole plate **536**, **636**, **736**. For example, as best shown in FIGS. **88** and **89**, the second plate **760** may include a plurality of raised portions **772** and grooves **774** that conform with the plurality of raised portions **764** and grooves **762** of the sole plate **736**.

EXAMPLES

The examples herein are intended to illustrate certain embodiments of the articles of footwear and sole structures discussed herein to one of ordinary skill in the art and should not be interpreted as limiting in the scope of the disclosure set forth in the claims. The articles of footwear and sole structures of the present disclosure may comprise the following non-limiting examples.

Example 1

Several studies were conducted to assess the performance of the sole structures discussed herein in comparison to other comparative sole structures. First, a mean relative maximum oxygen uptake for a subject wearing the sole structures **104**, **204**, **304** was measured and compared to the mean relative maximum oxygen uptake of the subject wearing comparative sole structures. These measurements were performed while the subject was running on a treadmill at various speeds, including 12 km/h, 14 km/h, and 16 km/h. The results of this study are shown in FIG. **90**.

Oxygen uptake or consumption is a measure of a person's ability to take in oxygen and deliver it to the working tissues of an athlete's body, but a lower mean relative maximum oxygen uptake equates to more efficient running. In other words, if a runner is more efficient by way of a more efficient and effective shoe sole, for example, the runner needs a lower amount of oxygen, and therefore, the runner would exhibit a lower mean relative maximum oxygen uptake. With reference to FIG. **90**, the sole structure **304** consistently had the lowest mean relative maximum oxygen uptake compared to other comparative soles across all speeds. However, at the higher speed of 16 km/h, the difference between the oxygen uptake values were accentuated and the article of footwear utilizing the sole structure **304** exhibited a mean relative maximum oxygen uptake of 49.1 ml/min/kg, which was far less than the other shoes having values greater than 51 ml/min/kg. The other sole structures **104**, **204** also exhibited very low oxygen uptake values in comparison to several of the comparative shoes. These results exhibit the improved efficiency the sole structures **104**, **204**, **304** can provide to a runner or athlete.

Example 2

Next, a mean heartrate of a subject wearing a shoe having the sole structures **104**, **204**, **304** was measured and compared to the heartrate of the subject wearing comparative sole structures. These measurements were performed while the subject was running on a treadmill at various speeds, including 12 km/h, 14 km/h, and 16 km/h.

The heartrate of a subject, like oxygen uptake, can be a measure of the efficiency of a runner and the efficiency of a sole structure worn by a runner. For example, if a runner is more efficient by way of a more efficient and effective sole structure, for example, the runner would have a lower mean heartrate. With reference to FIG. **91**, a runner wearing each sole structure **104**, **204**, **304** had a lower heartrate compared to several comparative shoe soles, which exhibits the improved efficiency imparted on a runner wearing a shoe having the sole structures **104**, **204**, **304**.

Example 3

The perceived exertion of the subjects was also documented after a subject ran on a treadmill at several speeds,

including 12 km/h, 14 km/h, and 16 km/h. More particularly, a subject was asked to run at a speed of 12 km/h, for example, and then asked to provide a rating of perceived exertion from a zero to ten scale with zero indicating no perceived level of exertion and ten indicating a very high level of perceived exertion by the subject. These values were documented for articles of footwear having the sole structures **104**, **204**, **304**, compared with several comparative shoe soles, and then graphed. The results of this experiment are shown in FIG. **92**, and as shown in FIG. **92**, runners or subjects consistently provided low ratings for articles of footwear having the sole structures **104**, **204**, **304**. In particular, subjects consistently provided the lowest mean rating of perceived exertion for the sole structure **304** compared to the other sole structures, which shows the beneficial experience subjects or runners have with the sole structure **304** during use thereof.

Example 4

The mean lactate concentration for a subject wearing the sole structures **104**, **204**, **304** was also measured and compared to the lactate concentration of a subject or runner wearing articles of footwear with comparable sole structures. These measurements were performed while the subject was running on a treadmill at various speeds, including 12 km/h, 14 km/h, and 16 km/h. The results of this study are shown in FIG. **93**.

Blood lactate levels can serve as an indirect marker for biochemical events, such as fatigue within exercising muscle. Further, the concentration of blood lactate is usually 1-2 mmol/L at rest, but can rise to greater than 20 mmol/L during intense exertion. In short, the higher lactate concentration within the blood is an indication of fatigue for a runner. Therefore, lower lactate concentrations are desired because lower lactate concentrations indicate more efficient running and a more efficient sole structure that provides a higher level of performance to a runner. With reference to FIG. **93**, each sole structure **104**, **204**, **304** performed exceptionally compared to other sole structures and provided low lactate concentrates compared to the other tested sole structures. As previously discussed herein, higher speeds (such as 16 km/h) can provide clearer data and more accentuated differences between the sole structures, and looking to the data collected at a running speed of 16 km/h, the sole structures **104**, **204**, **304** each registered lactate concentrations of about 3.2 mmol/l, which were significantly lower than the other comparable sole structures. As should be understood by one of ordinary skill in the art, these differences in lactate concentration (or decrease in lactate formation) can have a drastic and positive impact on runners during training, recovery, and performance activities, especially athletes or runners in endurance sports (e.g., marathon runners).

Example 5

In addition to measuring a lactate concentration of a subject or runner, a regression analysis rating of feeling and lactate concentration was performed. More particularly, for each sole structure, the subject or runner provided a perceived level of exhaustion using a zero to ten scale, with zero indicating no perceived level of exhaustion and ten indicating a very high level of exhaustion. Then these values were graphed with the lactate concentrations collected from Example 4 previously discussed herein. Specifically, for each speed and for each sole structure, the perceived levels of exhaustion for a runner were placed on a y-axis and their lactate concentrations were placed on the x-axis. This graph is shown in FIG. **94** and a regression analysis was performed to determine the statistical link between blood lactate concentration levels and perceived levels of exhaustion. After performing the regression analysis, the graph of FIG. **94** had an R-squared value of 0.92, thereby showing a strong statistical link between how tired runners felt and their lactate concentration in their blood.

Any of the embodiments described herein may be modified to include any of the structures or methodologies disclosed in connection with different embodiments. Further, the present disclosure is not limited to articles of footwear of the type specifically shown. Still further, aspects of the articles of footwear of any of the embodiments disclosed herein may be modified to work with any type of footwear, apparel, or other athletic equipment.

As noted previously, it will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

INDUSTRIAL APPLICABILITY

Numerous modifications to the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the invention. The exclusive rights to all modifications which come within the scope of the appended claims are reserved.

We claim:

1. An article of footwear having a sole structure and an upper, the sole structure comprising:

a first cushioning member directly coupled to the upper and extending continuously between a heel region and a midfoot region of the sole structure; and

a second cushioning member directly coupled to the upper and extending continuously between a forefoot region and the midfoot region of the sole structure,

wherein the first cushioning member and the second cushioning member overlap in the midfoot region and are spaced apart to define a gap that extends between the first cushioning member and the second cushioning member in the midfoot region of the sole structure, the gap having a centerline defined between the first cushioning member and the second cushioning member, the centerline following a contour of an end of at least one of the first cushioning member and the second cushioning member that bounds the gap when viewed from a bottom of the article of footwear; and

wherein at least one of the first cushioning member or the second cushioning member are a supercritical foam.

2. The article of footwear of claim **1**, further including an outsole defining a ground engaging surface, the outsole including a first outsole portion coupled to the first cushioning member and a second outsole portion coupled to the second cushioning member so that the ground engaging surface is not continuous along the midfoot region.

3. The article of footwear of claim **2**, wherein the first outsole portion includes a first heel outsole portion and a second heel outsole portion that are spaced apart from one another.

4. The article of footwear of claim **3**, wherein a groove extends between the first heel outsole portion and the second heel outsole portion.

5. The article of footwear of claim **1**, wherein the gap extends along a non-linear path between a lateral side and a medial side of the sole structure.

6. The article of footwear of claim **5**, wherein the non-linear path is a U-shaped path.

7. The article of footwear of claim **1**, wherein the first cushioning member includes an anterior protrusion that extends toward the second cushioning member, and the second cushioning member includes a posterior protrusion that extends toward the first cushioning member.

8. The article of footwear of claim **7**, wherein a terminal end of the anterior protrusion is disposed closer to a toe end of the sole structure than is a terminal end of the posterior protrusion.

9. The article of footwear of claim **1**, wherein the first cushioning member includes a distal end that terminates in the midfoot region of the sole structure and the second cushioning member includes a distal end that terminates in the midfoot region of the sole structure.

10. The article of footwear of claim **9**, wherein the first cushioning member and the second cushioning member overlap in the midfoot region of the sole structure, such that at least a portion of the distal end of the first cushioning member extends past at least a portion of the distal end of the second cushioning member.

11. The article of footwear of claim **1**, wherein the supercritical foam is formed by pressurizing a mixture of a supercritical fluid that includes nitrogen and a molten material of the cushioning member and then releasing the pressure to convert the supercritical fluid to a gas, which causes the material to expand and foam, thereby forming the pockets within the molten material.

12. An article of footwear having a sole structure and an upper, the sole structure comprising:

a midsole having a first cushioning member that is decoupled from a second cushioning member to define a gap therebetween that extends from a lateral side of the midsole to a medial side of the midsole,

wherein the first cushioning member extends at least partially through a midfoot region and includes a distal end that is U-shaped to define a notch between a first protrusion and a second protrusion,

wherein the second cushioning member extends at least partially through the midfoot region and includes a rounded distal end defining a third protrusion that extends toward the notch defined by the first cushioning member, and

wherein at least one of the first cushioning member of the second cushioning member are a supercritical foam, and

wherein the first cushioning member and the second cushioning member overlap in the midfoot region of the sole structure, such that at least a portion of the distal end of the first cushioning member extends past the rounded distal end of the second cushioning member.

13. The article of footwear of claim **12**, wherein a bottom surface of the upper is exposed along the gap between the first cushioning member and the second cushioning member.

14. The article of footwear of claim **12**, wherein the first cushioning member and the second cushioning member overlap so that, when viewed from a bottom of the article of footwear, the third protrusion extends into the notch while maintaining the gap between the first cushioning member and the second cushioning member.

15. The article of footwear of claim **14**, wherein both the first protrusion and the second protrusion extend past the third protrusion in a longitudinal direction.

16. The article of footwear of claim **12**, wherein the first cushioning member defines a first flex region and a second flex region that are separated by a flex groove.

17. The article of footwear of claim **16**, wherein a first outsole portion includes a first outsole element coupled to the first flex region and a second outsole element coupled to the second flex region.

18. The article of footwear of claim **12**, wherein the rounded distal end of the second cushioning member extends into the U-shaped distal end of the first cushioning member, such that the U-shaped distal end of the first cushioning member wraps around the rounded distal end of the second cushioning member while maintaining the gap therebetween.

19. The article of footwear of claim **12**, wherein the sole structure further includes an outsole defining a ground engaging surface and including a first outsole portion coupled to the first cushioning member and a second outsole portion coupled to the second cushioning member so that the ground engaging surface is not continuous along a midfoot region of the sole structure.

20. The article of footwear of claim **12**, wherein the supercritical foam is formed by pressurizing a mixture of a supercritical fluid that includes nitrogen and a molten material of the cushioning member and then releasing the pressure to convert the supercritical fluid to a gas, which causes the material to expand and foam, thereby forming the pockets within the molten material.

21. The article of footwear of claim **12**, wherein the first cushioning member is positioned in a heel region and the second cushioning member is positioned in a forefoot region.

22. The article of footwear of claim **12**, wherein the gap has a centerline defined between the first cushioning member and the second cushioning member, the centerline following a contour of an end of both the first cushioning member and the second cushioning member that bounds the gap when viewed from a bottom of the article of footwear.

23. An article of footwear having a sole structure and an upper, the sole structure comprising:

an outsole defining a ground-engaging surface;

a first cushioning member disposed between the outsole and the upper in a heel region of the sole structure, the first cushioning member including an anterior protrusion that extends into a midfoot region of the sole structure; and

a second cushioning member disposed between the outsole and the upper in a forefoot region of the sole structure, the second cushioning member including a posterior protrusion that extends into the midfoot region of the sole structure;

wherein the first cushioning member and the second cushioning member overlap in the midfoot region so that a toe end of the anterior protrusion extends past a heel end of the posterior protrusion in a longitudinal direction so that the toe end of the anterior protrusion is positioned closer to the forefoot region than is the heel end of the posterior protrusion,

wherein a gap extends between the first cushioning member and the second cushioning member from a lateral side of the sole structure to a medial side of the sole structure, the gap having a centerline defined between the first cushioning member and the second cushioning member, the centerline following a contour of an end of at least one of the first cushioning member and the second cushioning member, and

wherein at least one of the first cushioning member or the second cushioning member are supercritical foams.

24. The article of footwear of claim **23**, wherein the second cushioning member includes a longitudinal length defined by a length from a forefoot end of the second cushioning member to the heel end of the posterior protrusion, wherein the first cushioning member includes a longitudinal length defined by a length from the toe end of the anterior protrusion to a heel end of the first cushioning member, and wherein the longitudinal length of the second cushioning member is greater than the longitudinal length of the first cushioning member.

25. The article of footwear of claim **23**, wherein the posterior protrusion is positioned along a medial half of the sole structure.

26. The article of footwear of claim **23**, wherein the supercritical foam is formed by pressurizing a mixture of a supercritical fluid that includes nitrogen and a molten material of the cushioning member and then releasing the pressure to convert the supercritical fluid to a gas, which causes the material to expand and foam, thereby forming the pockets within the molten material.

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EXHIBIT C

US011974630B2

(12) **United States Patent**
Bonin et al.

(10) **Patent No.: US 11,974,630 B2**
(45) **Date of Patent: May 7, 2024**

(54) **ARTICLE OF FOOTWEAR HAVING A SOLE PLATE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/243,981**

(22) Filed: **Sep. 8, 2023**

(65) **Prior Publication Data**

US 2023/0413945 A1 Dec. 28, 2023

Related U.S. Application Data

(63) Continuation of application No. 18/109,991, filed on Feb. 15, 2023, which is a continuation of application No. 17/218,353, filed on Mar. 31, 2021.

(60) Provisional application No. 63/139,447, filed on Jan. 20, 2021.

(51) **Int. Cl.**
A43B 13/18 (2006.01)

(52) **U.S. Cl.**
CPC ***A43B 13/186*** (2013.01); ***A43B 13/183*** (2013.01); ***A43B 13/188*** (2013.01)

(58) **Field of Classification Search**
CPC ... A43B 13/186; A43B 13/188; A43B 13/026; A43B 13/145; A43B 13/185; A43B 13/26; A43B 13/183; A43B 13/181; A43B 13/141; A43B 13/122; A43B 5/06; A43C 15/02; A43C 15/16; A43C 15/161; A43C 15/162; A43C 15/168
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

324,065 A	8/1885	Andrews
413,693 A	10/1889	Walker
634,588 A	10/1899	Roche
1,088,328 A	2/1914	Cucinotta et al.
4,020,569 A	5/1977	Fukuoka
4,241,523 A	12/1980	Daswick
4,348,821 A	9/1982	Daswick

(Continued)

FOREIGN PATENT DOCUMENTS

CN	2904704 Y	5/2007
CN	204132549 U	2/2015

(Continued)

OTHER PUBLICATIONS

International Search Report of International Application No. PCT/IB2021/062487, dated Mar. 30, 2022, 7 pages.

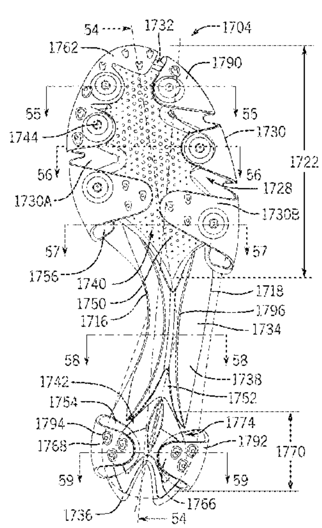
(Continued)

Primary Examiner — Khoa D Huynh
Assistant Examiner — Haley A Smith
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

(57) **ABSTRACT**

An article of footwear includes an upper and a sole structure coupled to the upper. The sole structure defines a ground engaging surface, and includes a cushioning member coupled to the upper and an outsole coupled to the cushioning member. The outsole includes a central portion and a plurality of lobes extending outward from a periphery of the central portion. Each of the plurality of lobes is independently movable relative to one another.

29 Claims, 40 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,392,312 A 7/1983 Crowley
4,463,505 A 8/1984 Duclos
4,492,046 A 1/1985 Kosova
4,510,700 A 4/1985 Brown
4,542,598 A 9/1985 Misevich et al.
4,910,884 A 3/1990 Lindh et al.
5,024,007 A 6/1991 DuFour
5,052,130 A 10/1991 Barry et al.
5,138,776 A 8/1992 Levin
5,191,727 A 3/1993 Barry et al.
5,203,095 A 4/1993 Allen
5,339,544 A 8/1994 Caberlotto
5,353,523 A 10/1994 Kilgore et al.
5,435,079 A 7/1995 Gallegos
5,461,800 A 10/1995 Luthi et al.
5,528,842 A 6/1996 Ricci et al.
5,592,757 A 1/1997 Jackinsky
5,706,589 A 1/1998 Marc
5,806,209 A 9/1998 Crowley et al.
5,875,567 A 3/1999 Bayley
6,029,374 A 2/2000 Herr et al.
6,502,330 B1 1/2003 David et al.
6,505,421 B1 1/2003 Vaz
6,775,930 B2 8/2004 Fuerst
6,826,852 B2 12/2004 Fusco
6,857,205 B1 2/2005 Fusco et al.
6,944,972 B2 9/2005 Schmid
7,013,582 B2 3/2006 Lucas et al.
7,016,867 B2 3/2006 Lyden
7,096,605 B1 8/2006 Kozo et al.
7,100,308 B2 9/2006 Aveni
7,100,309 B2 9/2006 Smith et al.
7,107,235 B2 9/2006 Lyden
7,152,343 B2 12/2006 Whatley
7,219,447 B2 5/2007 LeVert
7,350,320 B2 4/2008 Chandler et al.
7,401,419 B2 7/2008 Lucas et al.
7,401,422 B1 7/2008 Scholz et al.
7,434,337 B2 10/2008 Gibert et al.
7,484,317 B2 2/2009 Kita et al.
7,513,065 B2 4/2009 Kita et al.
7,624,515 B2 12/2009 Kita et al.
7,644,518 B2 1/2010 Chandler et al.
7,707,743 B2 5/2010 Schindler et al.
7,786,193 B2 8/2010 Wilding et al.
7,832,117 B2 11/2010 Auger et al.
7,886,461 B2 2/2011 Sato
7,900,376 B2 3/2011 Rabushka
7,950,091 B2 5/2011 Auger et al.
7,987,618 B2 8/2011 Nishiwaki et al.
8,028,442 B2 10/2011 Hodgson
8,074,377 B2 12/2011 Nishiwaki et al.
8,079,160 B2 12/2011 Baucom et al.
8,112,909 B2 2/2012 Kubo et al.
8,122,615 B2 2/2012 Lucas et al.
8,341,856 B2 1/2013 Smith et al.
8,393,028 B2 3/2013 Namkook et al.
8,418,379 B2 4/2013 Nishiwaki et al.
D688,037 S 8/2013 Dekovic
8,567,094 B2 10/2013 Lubart
8,613,149 B2 12/2013 Schwirian
8,615,901 B2 12/2013 Caine et al.
D707,428 S 6/2014 Seamarks
8,776,397 B2 7/2014 Borel et al.
8,850,718 B2 10/2014 Lubart
8,919,015 B2 12/2014 Holt et al.
8,945,449 B2 2/2015 Atwal et al.
8,978,274 B2 3/2015 Auger et al.
8,984,775 B2 3/2015 Dombrow et al.
9,009,988 B2 4/2015 Jacobs et al.
9,066,559 B2 6/2015 Butler
9,144,265 B2 9/2015 Lubart
9,167,864 B1 10/2015 Piontkowski et al.
9,179,733 B2 11/2015 Peyton et al.
9,204,686 B2 12/2015 Baum et al.
9,210,967 B2 12/2015 Gerber
9,241,533 B2 1/2016 Heard et al.
9,259,050 B2 2/2016 Smith et al.
9,326,562 B2 5/2016 Weidl et al.
9,339,079 B2 5/2016 Lucas et al.
9,375,048 B2 6/2016 James et al.
9,491,983 B2 11/2016 Rushbrook
9,516,916 B2 12/2016 Derrier
9,549,589 B2 1/2017 Auger et al.
9,572,394 B2 2/2017 Heard et al.
9,572,398 B2 2/2017 Hurd et al.
9,615,625 B1 4/2017 Huard et al.
9,661,896 B2 5/2017 Elliott et al.
9,668,540 B2 6/2017 Scofield et al.
9,750,306 B2 9/2017 Baum et al.
9,775,404 B2 10/2017 Lyden
9,820,528 B2 11/2017 Reinhardt et al.
9,820,529 B2 11/2017 Droege et al.
9,883,714 B2 2/2018 Cavaliere et al.
9,894,958 B2 2/2018 Cheney et al.
9,930,934 B2 4/2018 Cook et al.
9,961,959 B2 5/2018 Gerber
9,968,157 B2 5/2018 Wardlaw et al.
9,968,160 B2 5/2018 Peyton
10,010,135 B2 7/2018 Lovell et al.
10,010,137 B2 7/2018 Foxen
10,016,919 B2 7/2018 Cook et al.
10,111,491 B2 10/2018 Tanabe et al.
10,159,303 B2 12/2018 Wang et al.
10,165,821 B2 1/2019 Truelsen
10,165,824 B2 1/2019 Auger et al.
10,226,097 B2 3/2019 Farris et al.
10,231,517 B2 3/2019 Baucom et al.
10,271,614 B2 4/2019 Huard et al.
10,299,535 B2 5/2019 Hurd et al.
10,314,365 B2 6/2019 James et al.
10,314,367 B2 6/2019 Kilgore et al.
10,349,700 B2 7/2019 Amis et al.
10,433,616 B2 10/2019 Takeshita et al.
10,441,027 B2 10/2019 Bartel et al.
10,448,701 B2 10/2019 Farris et al.
10,448,704 B2 10/2019 Dupre et al.
10,512,301 B2 12/2019 Peyton
10,517,350 B2 12/2019 Orand et al.
10,517,351 B2 12/2019 Arciuolo
10,524,536 B2 1/2020 Bunnell et al.
10,548,368 B2 2/2020 Bartel et al.
10,595,587 B2 3/2020 Cook et al.
10,653,205 B2 5/2020 Orand
10,743,606 B2 8/2020 Bartel et al.
10,743,607 B2 8/2020 Amis et al.
10,750,817 B2 8/2020 Barnes et al.
10,758,001 B2 9/2020 Case et al.
D913,663 S 3/2021 Essilfie-Taylor
D954,417 S 6/2022 Bidal
D964,717 S 9/2022 Mahoney
D973,337 S 12/2022 Lesecq
2002/0174567 A1 11/2002 Krafsur et al.
2003/0208929 A1 11/2003 Lucas et al.
2003/0233770 A1 12/2003 Foscaro
2004/0107601 A1 6/2004 Schmid
2004/0200097 A1 10/2004 Boyd
2005/0102858 A1 5/2005 Yen
2005/0126039 A1 6/2005 LeVert
2005/0155254 A1 7/2005 Smith
2005/0166422 A1 8/2005 Schaeffer et al.
2005/0262739 A1 12/2005 McDonald
2006/0196084 A1 9/2006 Kos
2007/0043630 A1 2/2007 Lyden
2007/0101617 A1 5/2007 Brewer et al.
2007/0240331 A1 10/2007 Borel
2007/0266593 A1 11/2007 Schindler et al.
2007/0271818 A1 11/2007 Rabushka
2008/0072462 A1* 3/2008 Fusco A43C 15/168
36/103
2008/0189982 A1 8/2008 Krafsur
2009/0100718 A1 4/2009 Gerber
2009/0178303 A1* 7/2009 Hurd A43B 13/026
36/107

(56) **References Cited**

U.S. PATENT DOCUMENTS

2009/0183393 A1 7/2009 Lee
2009/0249648 A1* 10/2009 Brown A43B 13/26 36/134
2009/0307925 A1 12/2009 Pfister
2010/0175280 A1 7/2010 Rinehart, Jr.
2010/0186261 A1 7/2010 Baker
2010/0218397 A1 9/2010 Nishiwaki et al.
2010/0263228 A1 10/2010 Kang
2011/0088287 A1* 4/2011 Auger A43B 13/125 36/114
2011/0138652 A1* 6/2011 Lucas A43B 13/14 36/28
2011/0214314 A1* 9/2011 Baker A43C 15/168 36/134
2012/0079747 A1* 4/2012 Seo .... A43B 13/183 36/25 R
2012/0174432 A1 7/2012 Peyton
2012/0317835 A1 12/2012 Raysse et al.
2013/0067772 A1* 3/2013 Auger A43B 13/188 36/103
2013/0192090 A1 8/2013 Smith
2013/0199057 A1* 8/2013 Hurd A43B 13/184 36/88
2014/0068966 A1 3/2014 Chaffin
2014/0101972 A1* 4/2014 Ha A43B 13/181 36/102
2014/0230280 A1 8/2014 Heard et al.
2014/0230283 A1 8/2014 Cordova
2014/0237852 A1 8/2014 Oberschneider et al.
2014/0245640 A1 9/2014 Heard et al.
2015/0047224 A1 2/2015 Zhao et al.
2015/0107132 A1 4/2015 Takeshita
2016/0000180 A1* 1/2016 Cook A43B 13/122 36/103
2016/0001478 A1* 1/2016 Cook A43C 15/02 264/244
2016/0262492 A1 9/2016 Fujita
2017/0079376 A1 3/2017 Bunnell et al.
2017/0105477 A1 4/2017 Wilkerson
2017/0150779 A1 6/2017 Walker et al.
2017/0150780 A1 6/2017 Walker
2017/0196305 A1 7/2017 Barnes
2017/0245590 A1 8/2017 Kohatsu et al.
2018/0027922 A1 2/2018 Orand
2018/0035752 A1 2/2018 Walker et al.
2018/0042338 A1 2/2018 Orand
2018/0146743 A1 5/2018 Amos
2018/0153254 A1 6/2018 Fusco et al.
2018/0168281 A1 6/2018 Case et al.
2018/0199666 A1 7/2018 Moriyasu et al.
2018/0199675 A1 7/2018 Cook et al.
2018/0235310 A1 8/2018 Wardlaw et al.
2018/0271215 A1 9/2018 Foxen
2018/0338568 A1 11/2018 Chambers et al.
2018/0352902 A1 12/2018 Wardle
2019/0082781 A1 3/2019 Iuchi et al.
2019/0150558 A1 5/2019 Shorten
2019/0150563 A1 5/2019 Shorten
2019/0159547 A1 5/2019 Nakatsuka
2019/0216169 A1 7/2019 Yahata
2019/0246738 A1* 8/2019 Connell A43B 23/0245
2019/0283355 A1 9/2019 Bartel et al.
2019/0289961 A1 9/2019 Iuchi et al.
2019/0320759 A1 10/2019 Conrad et al.
2019/0365030 A1 12/2019 Chambers et al.
2019/0365033 A1 12/2019 Chambers et al.
2019/0365034 A1 12/2019 Connell et al.
2019/0373982 A1 12/2019 Dupre et al.
2020/0008519 A1 1/2020 Farris et al.
2020/0046068 A1 2/2020 Choi et al.
2020/0100564 A1 4/2020 Bunnell et al.
2020/0121021 A1 4/2020 Bartel et al.
2020/0281314 A1* 9/2020 Stockbridge B29D 35/128
2020/0281322 A1 9/2020 Caldwell et al.
2020/0307134 A1 10/2020 Yoshida
2021/0015209 A1 1/2021 Buck
2021/0030112 A1 2/2021 Amoako et al.
2021/0052037 A1 2/2021 Greenspan
2021/0085024 A1 3/2021 Chen
2021/0368916 A1 12/2021 Wakasugi
2022/0015505 A1 1/2022 Constantinou

FOREIGN PATENT DOCUMENTS

CN	204467084	U	7/2015
DE	4015138	A1	11/1991
DE	102012104264	A1	11/2013
DE	102018122753	A1	3/2019
DE	102019107402	A1	9/2019
EP	1483981	A1	12/2004
EP	1346655	B1	8/2006
EP	1525284	B1	6/2007
EP	2138063	A1	12/2009
EP	2689681	A1	1/2014
EP	2491807	B1	10/2014
EP	1847193	B1	1/2015
EP	1386553	B1	6/2015
EP	2269478	B1	9/2015
EP	1690460	B1	8/2016
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EP	2979567	B1	10/2018
EP	3399882	A1	11/2018
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EP	3422893	A1	1/2019
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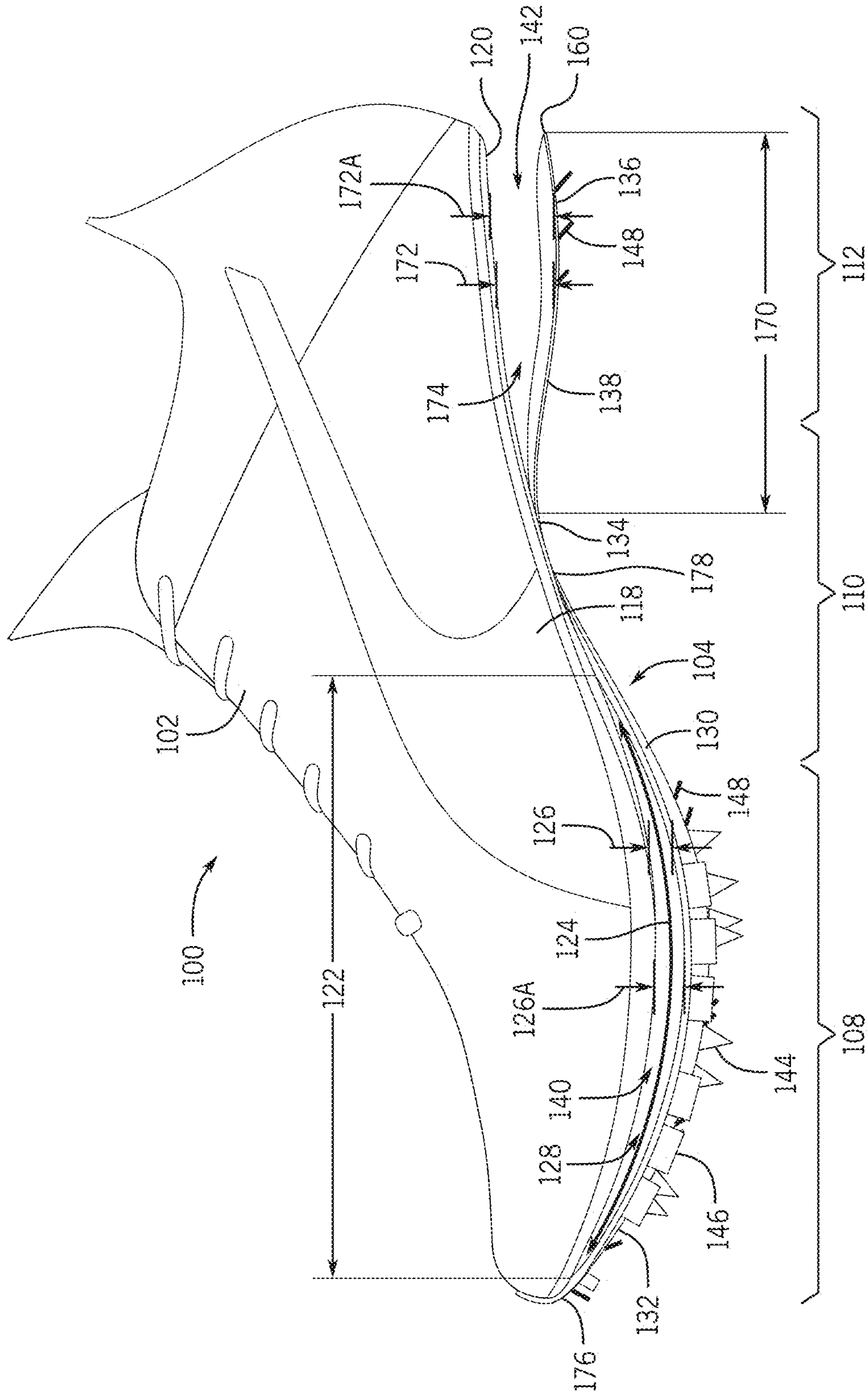
EP	3689171	A1	8/2020
EP	3771358	A1	2/2021
FR	2827126	A1	1/2003
FR	2932963	B1	8/2010
FR	2993758	B1	3/2015
GB	2376408	A	12/2002
KR	100844183	B1	7/2008
WO	9842221	A1	10/1998
WO	2000074515	A1	12/2000
WO	2007113595	A2	10/2007
WO	2008125716	A1	10/2008
WO	2011020798	A1	2/2011
WO	2013023163	A1	2/2013
WO	2016094714	A1	6/2016
WO	2017023532	A1	2/2017
WO	2017120006	A1	7/2017
WO	2017151501	A1	9/2017
WO	2019157244	A1	8/2019
WO	2021016163	A1	1/2021

OTHER PUBLICATIONS

Written Opinion of International Application No. PCT/IB2021/062487, dated Mar. 30, 2022, 7 pages.
[Adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https:// www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/BO119E37WS/ref=cm_cr_arp_d_product_top?ie=UTFS (Year: 2015), 4 pages.
[Puma EvoSpeed Sprint 14], announced on YouTube on Jan. 5, 2023 [online], [site visited May 5, 2023], Available from the internet URL: Puma evoSpeed Sprint 14 SKU: 9787857 (Year: 2023), 3 pages.

* cited by examiner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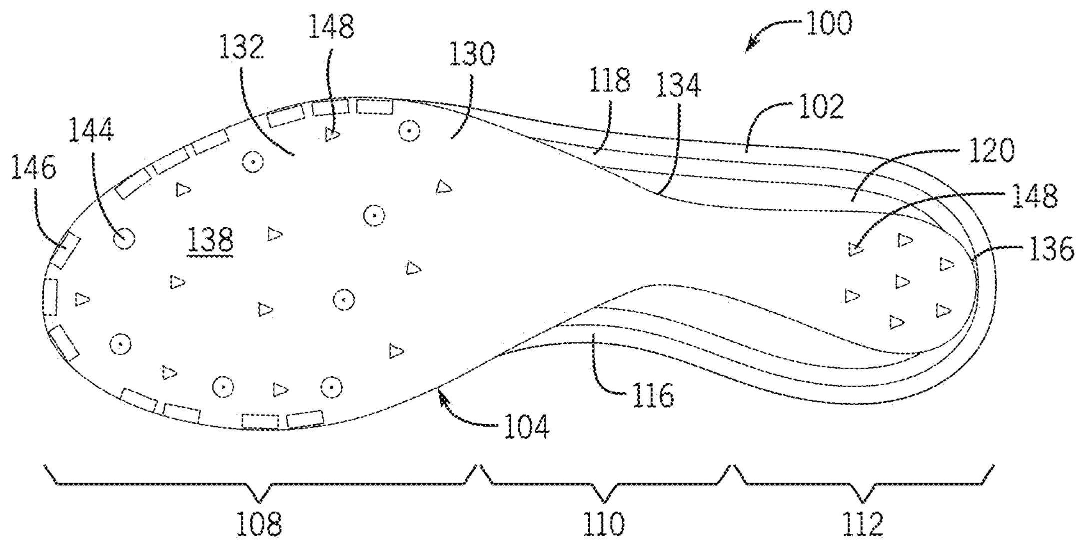
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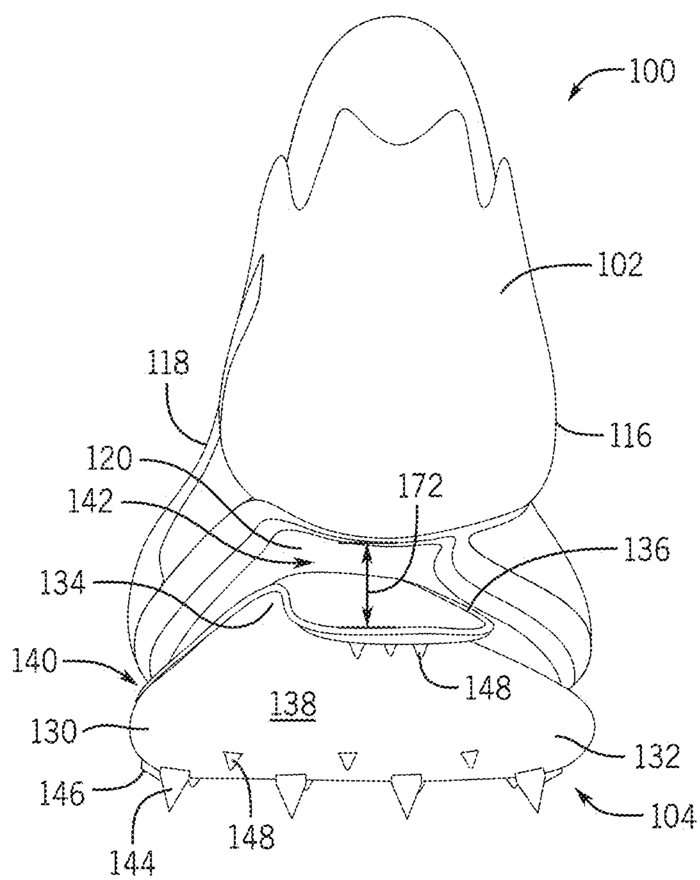
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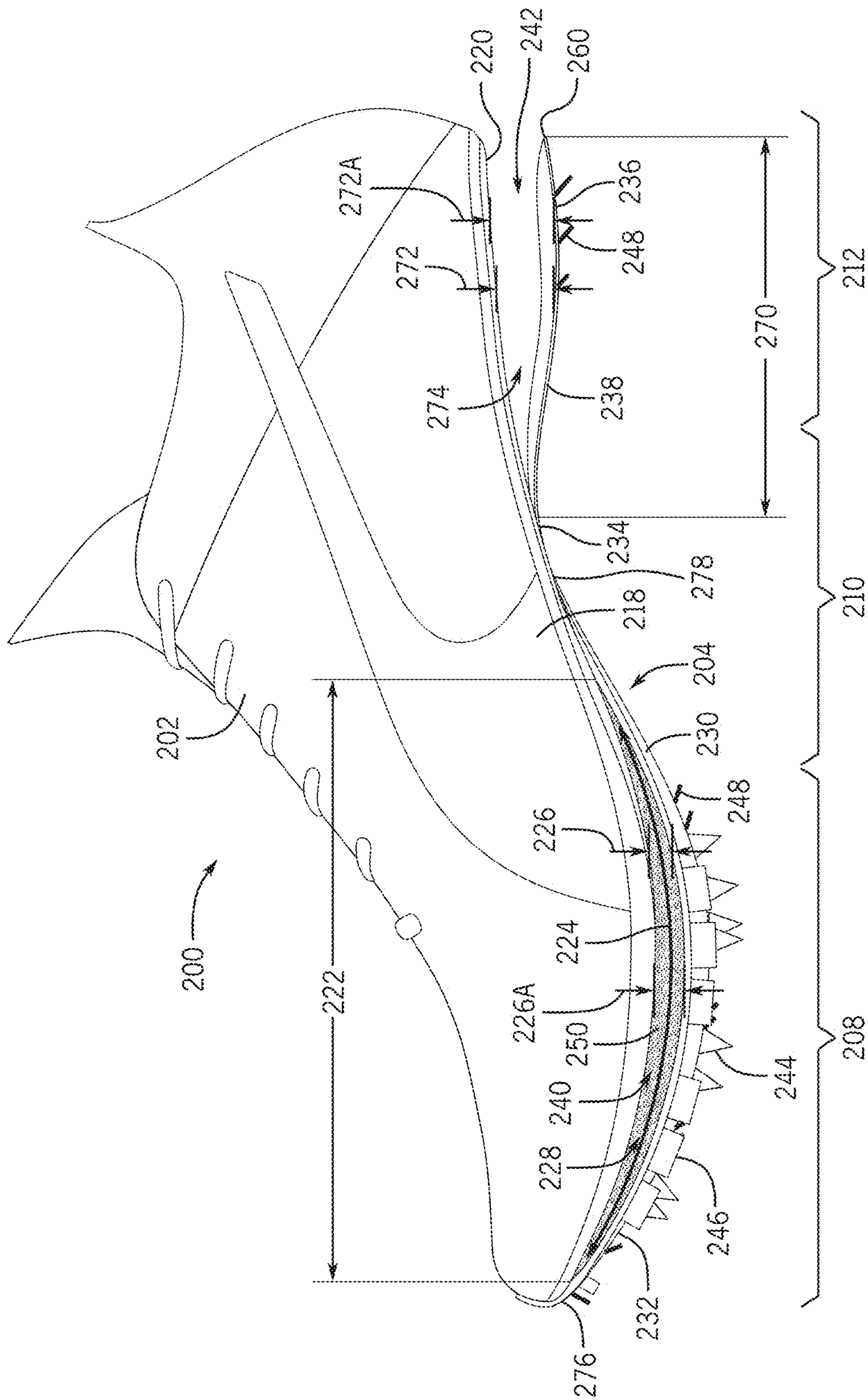
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FIG. 4

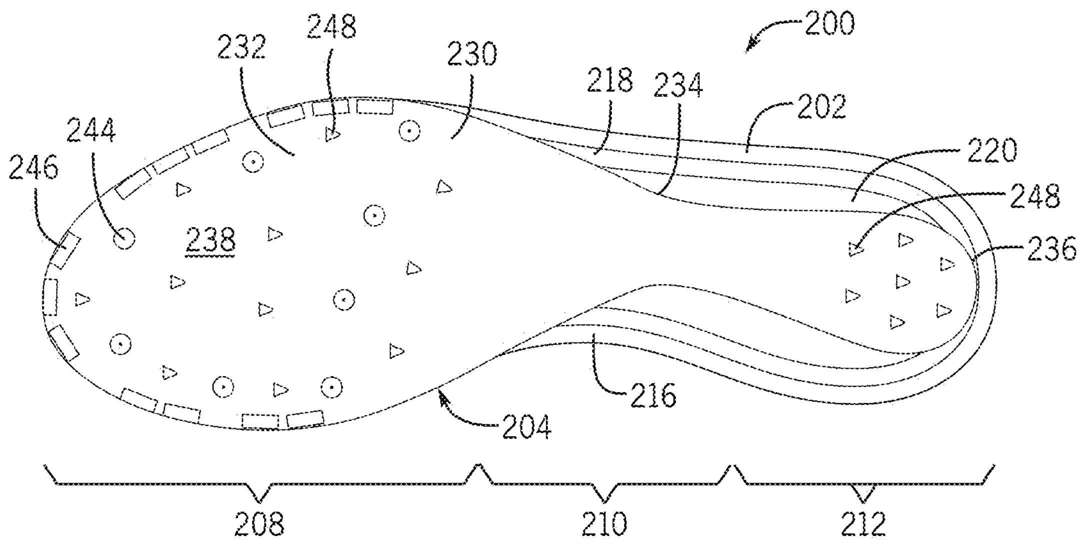
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FIG. 5

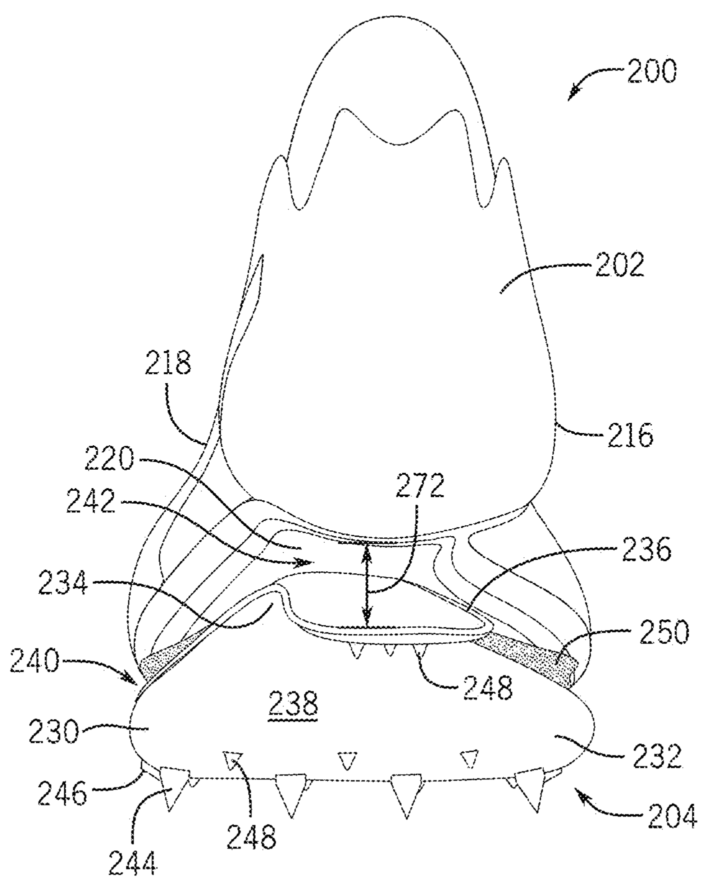
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FIG. 6

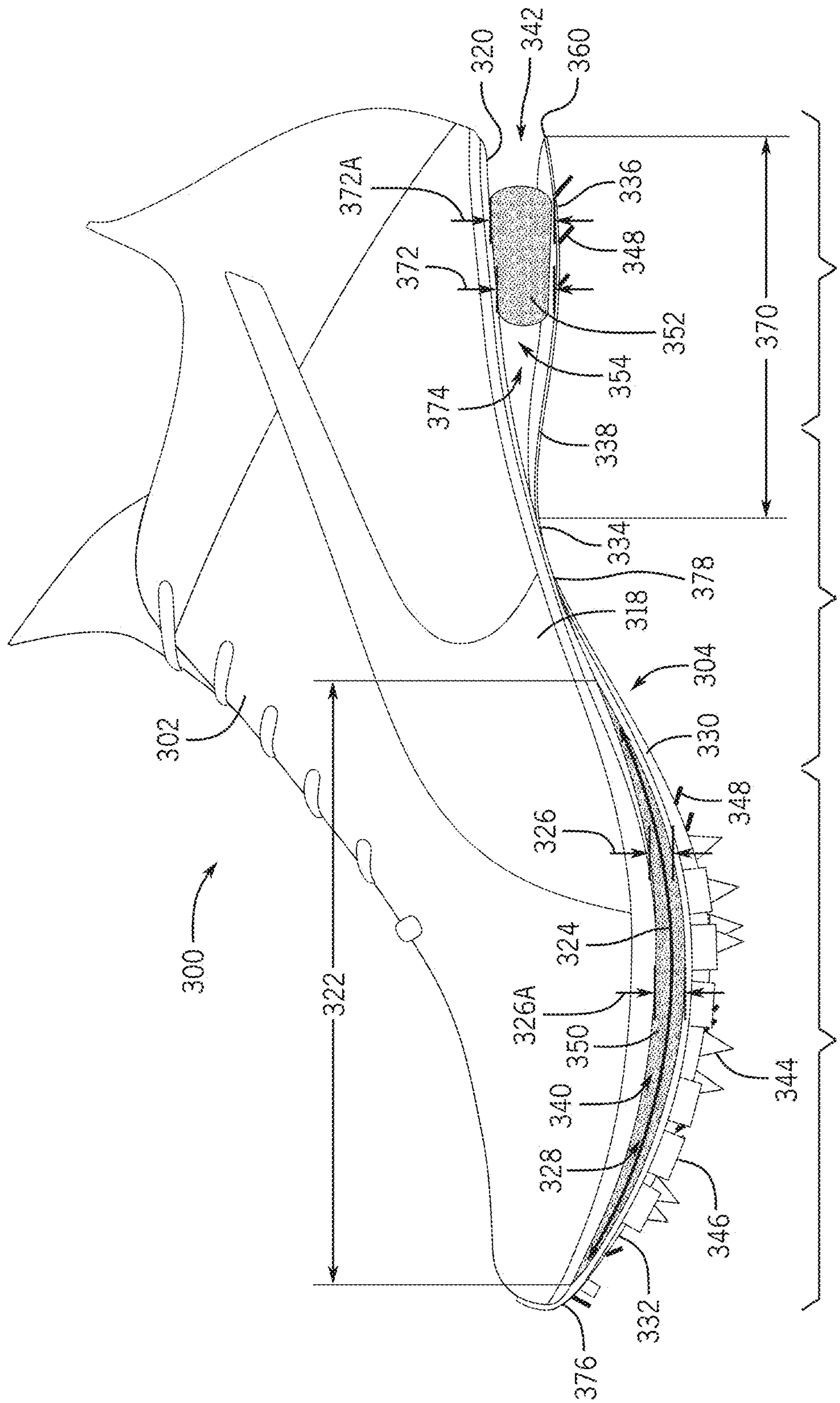

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FIG. 7

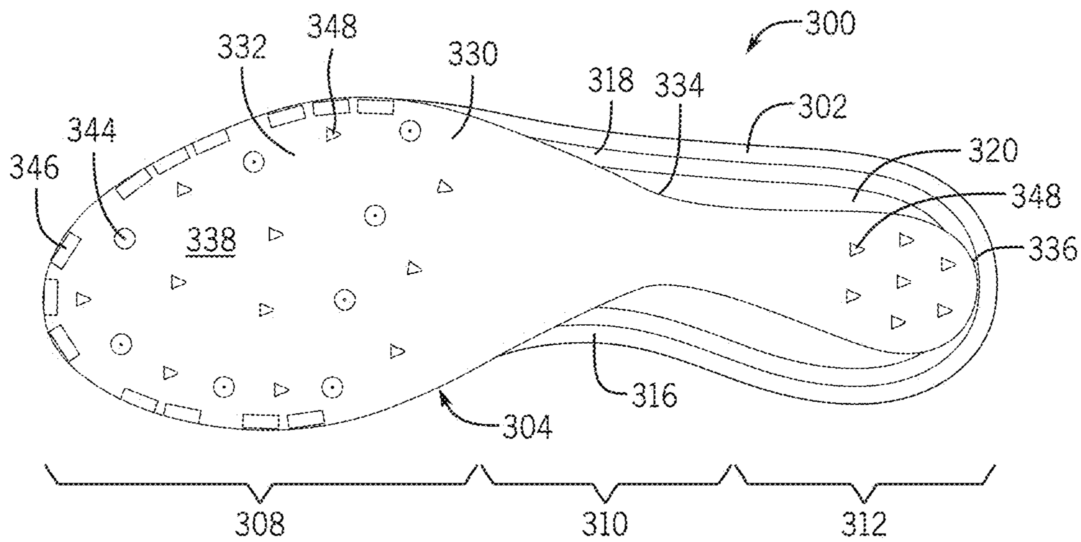

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FIG. 8

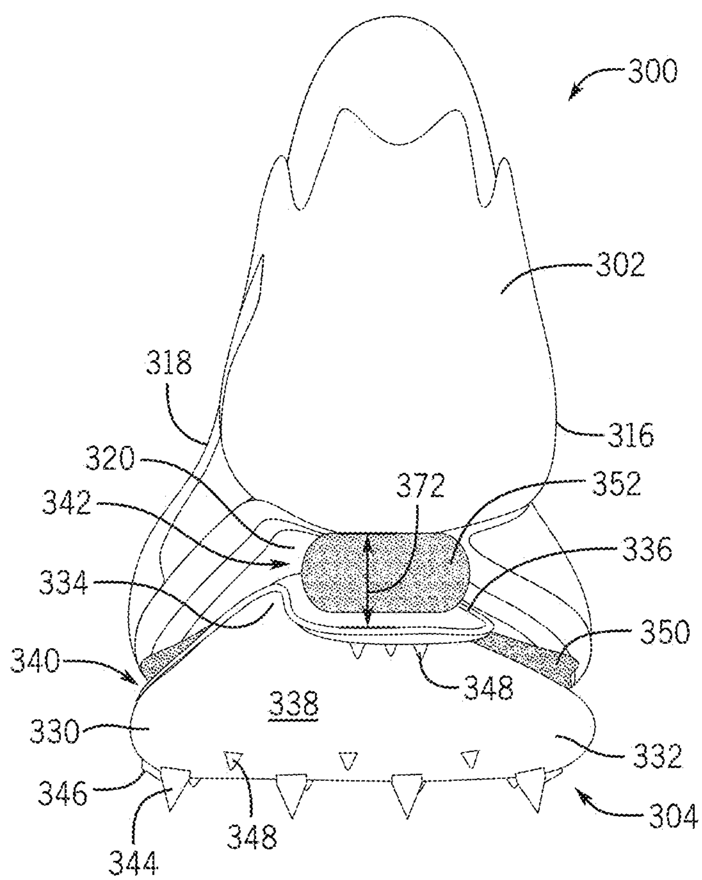

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FIG. 9

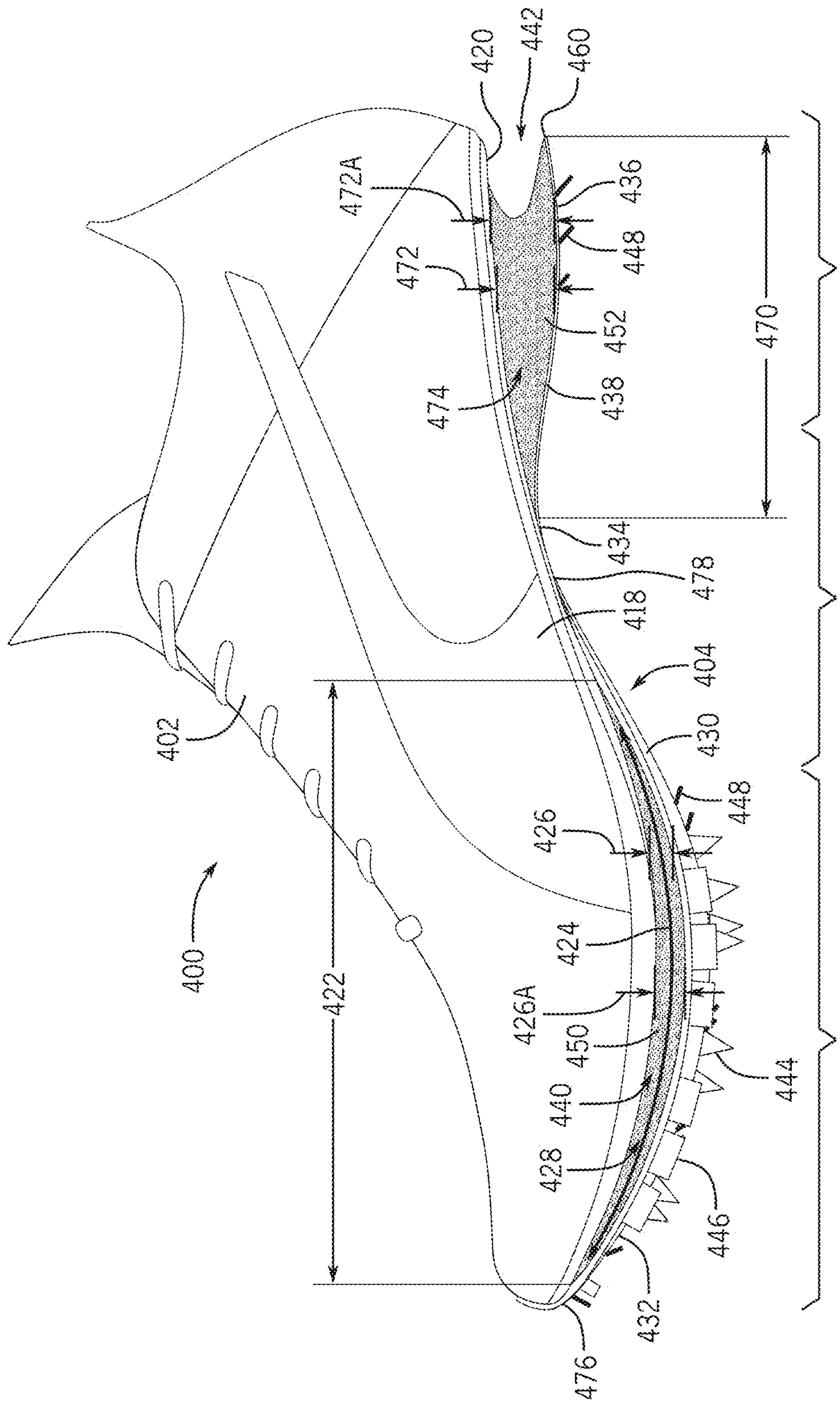

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FIG. 10

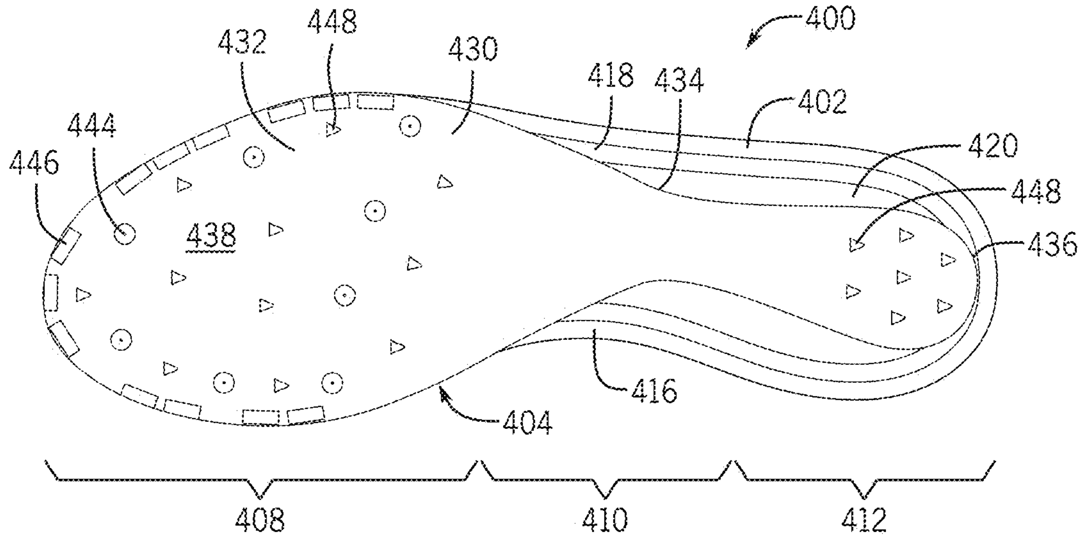
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FIG. 11

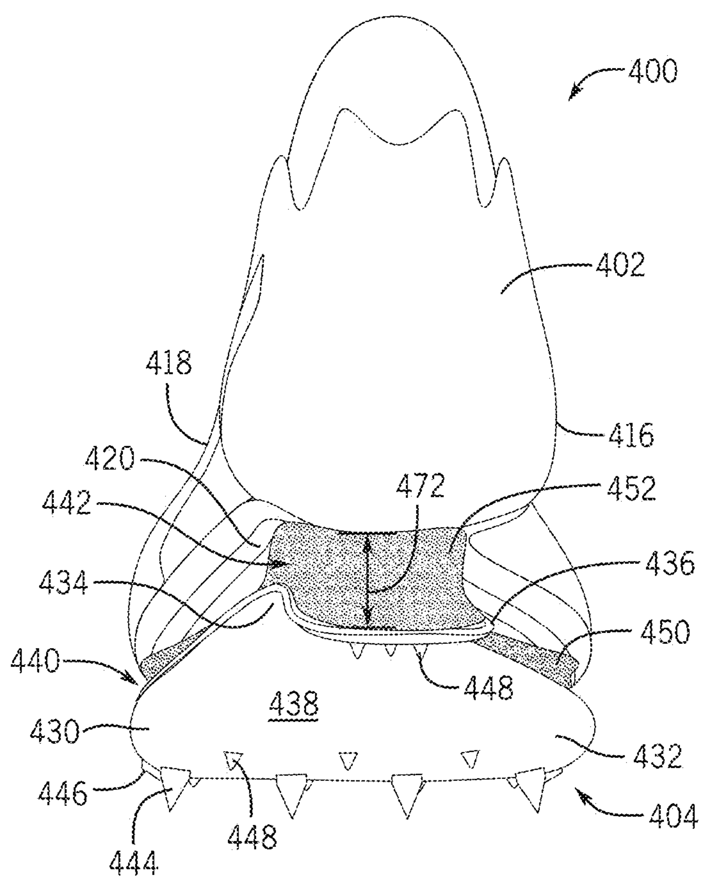
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FIG. 12

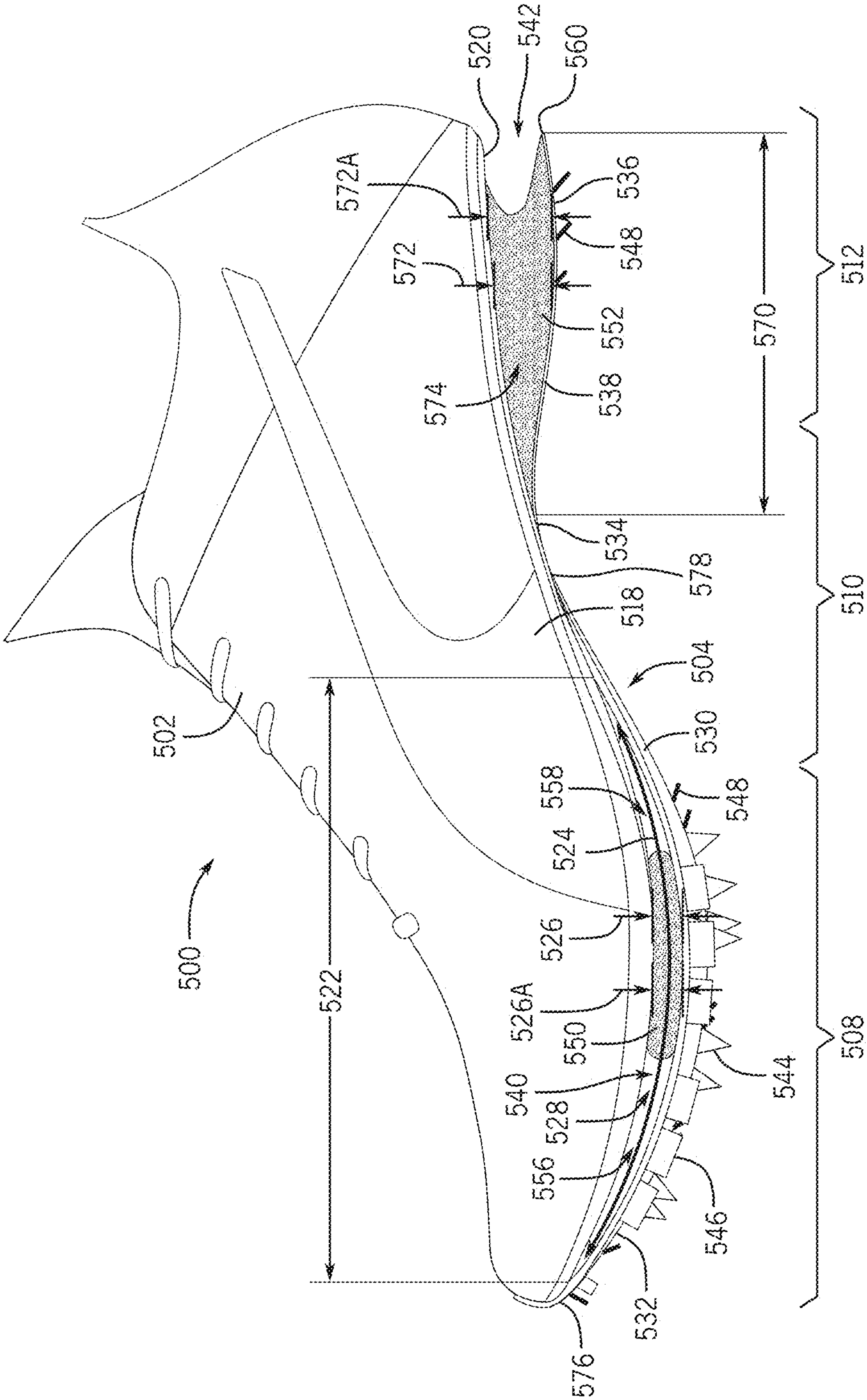
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FIG. 13

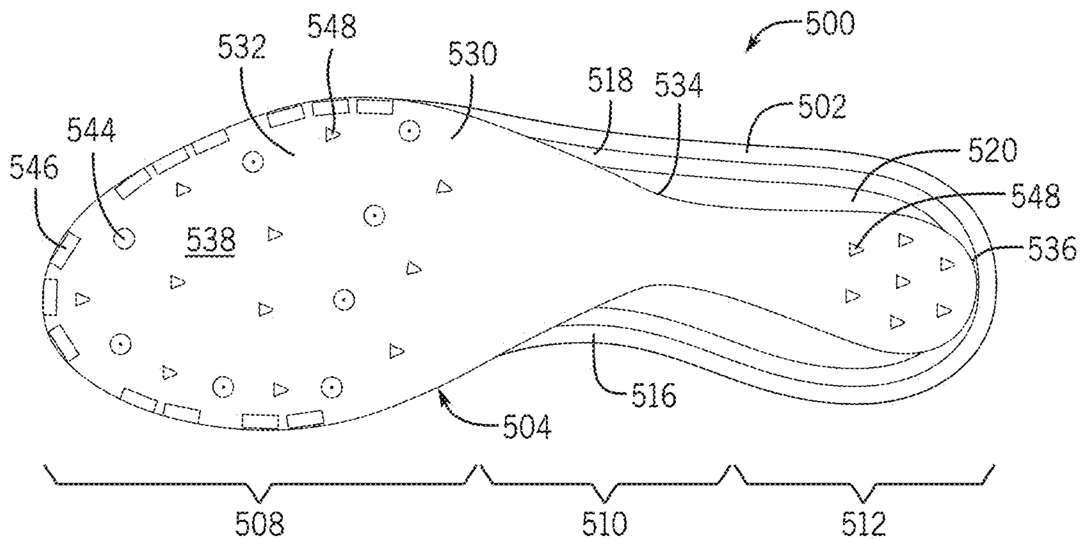
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FIG. 14

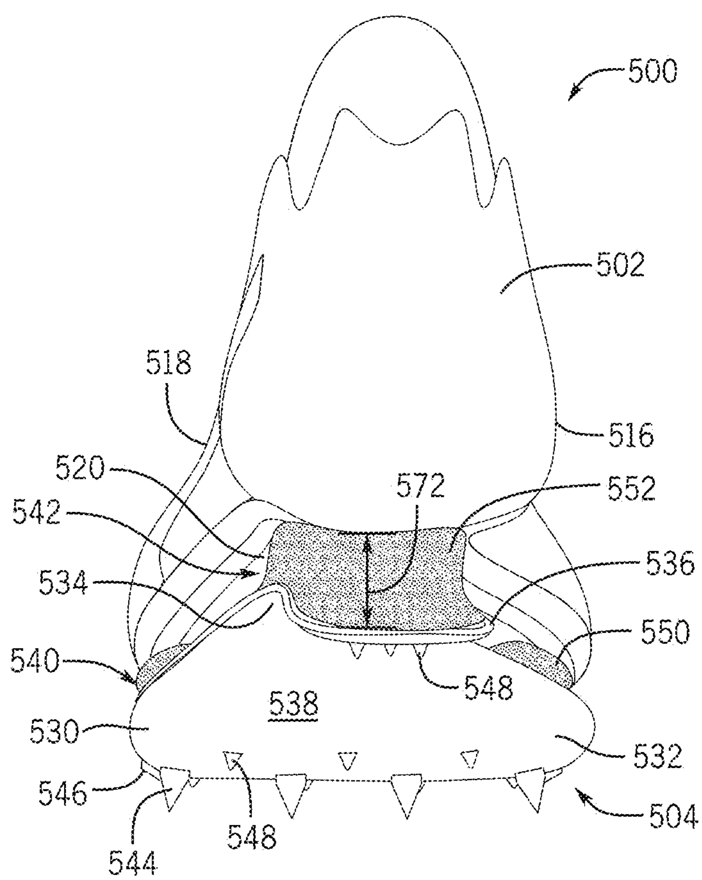
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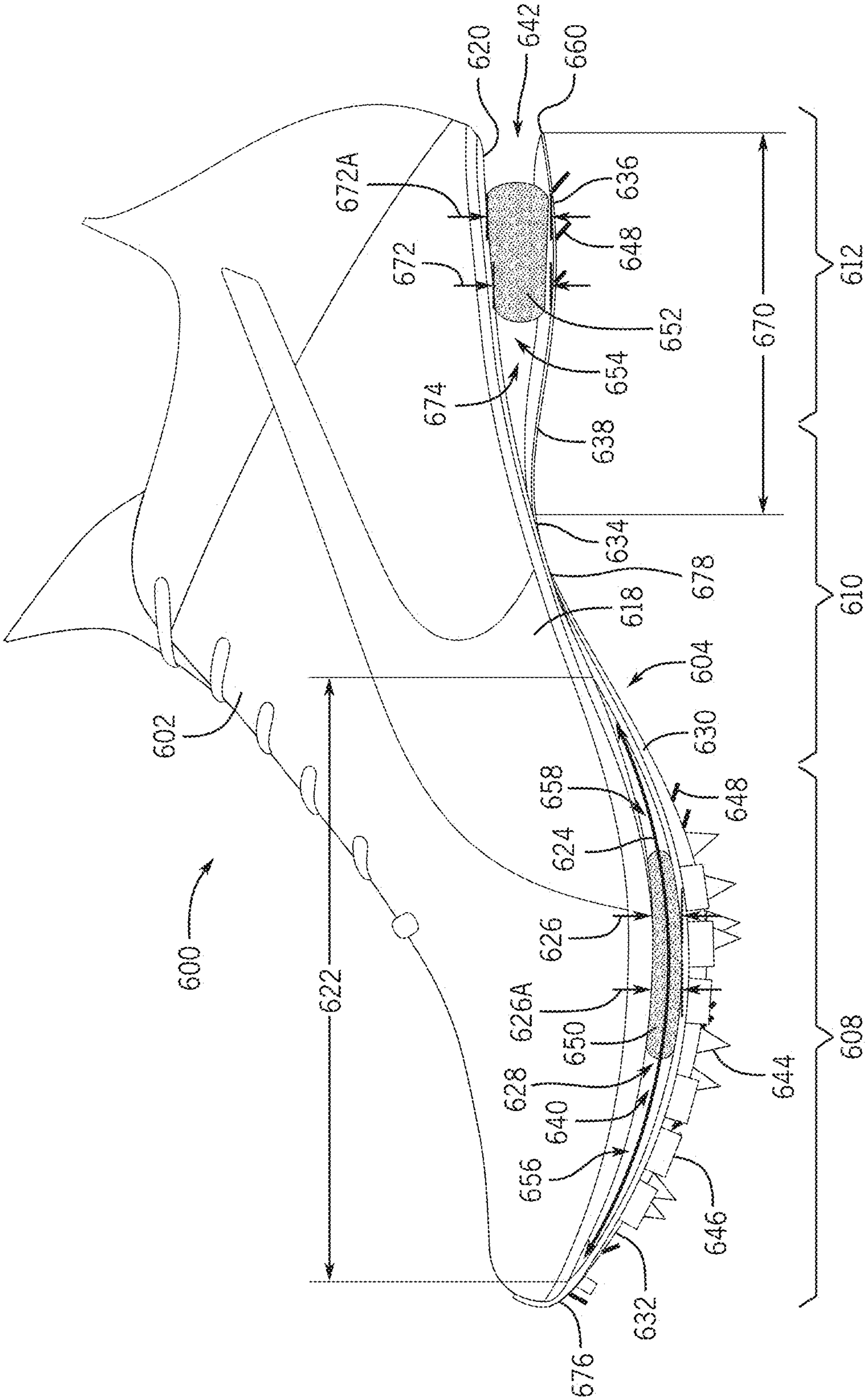
FIG. 15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636
638
640
642
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656
658
660
670
672
672A
674
676
678

FIG. 16

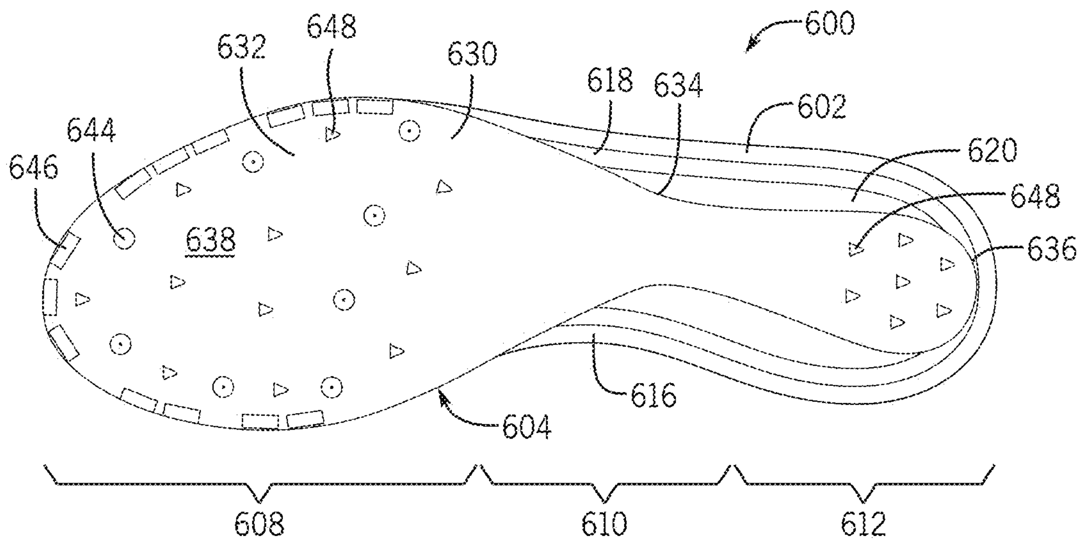

600
632
648
630
618
634
602
644
646
620
648
636
638
616
604
608
610
612

FIG. 17

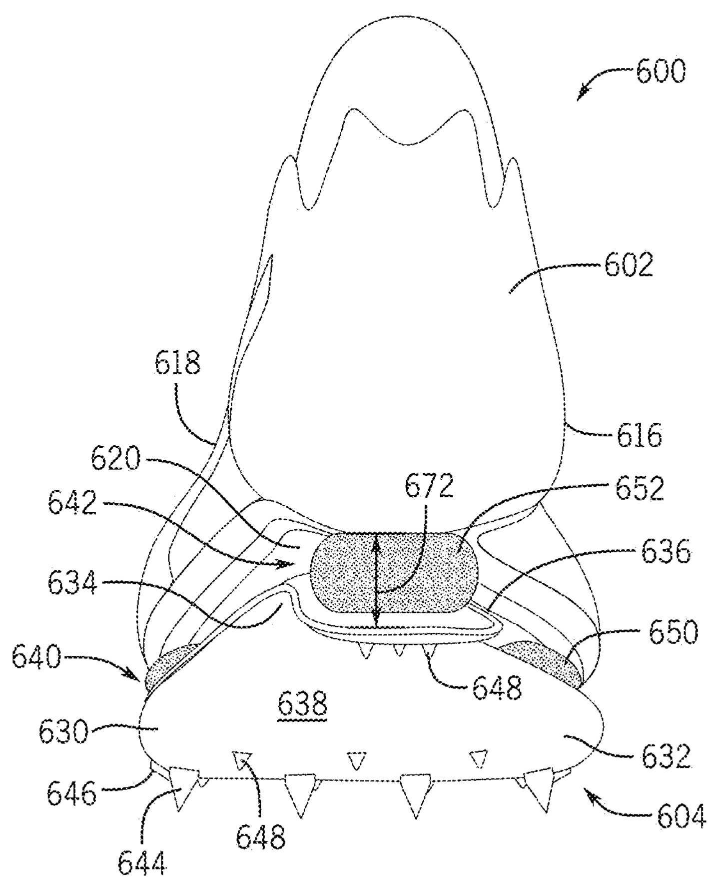

600
602
618
616
620
672
652
642
636
634
650
640
648
638
630
632
646
604
644
648

FIG. 18

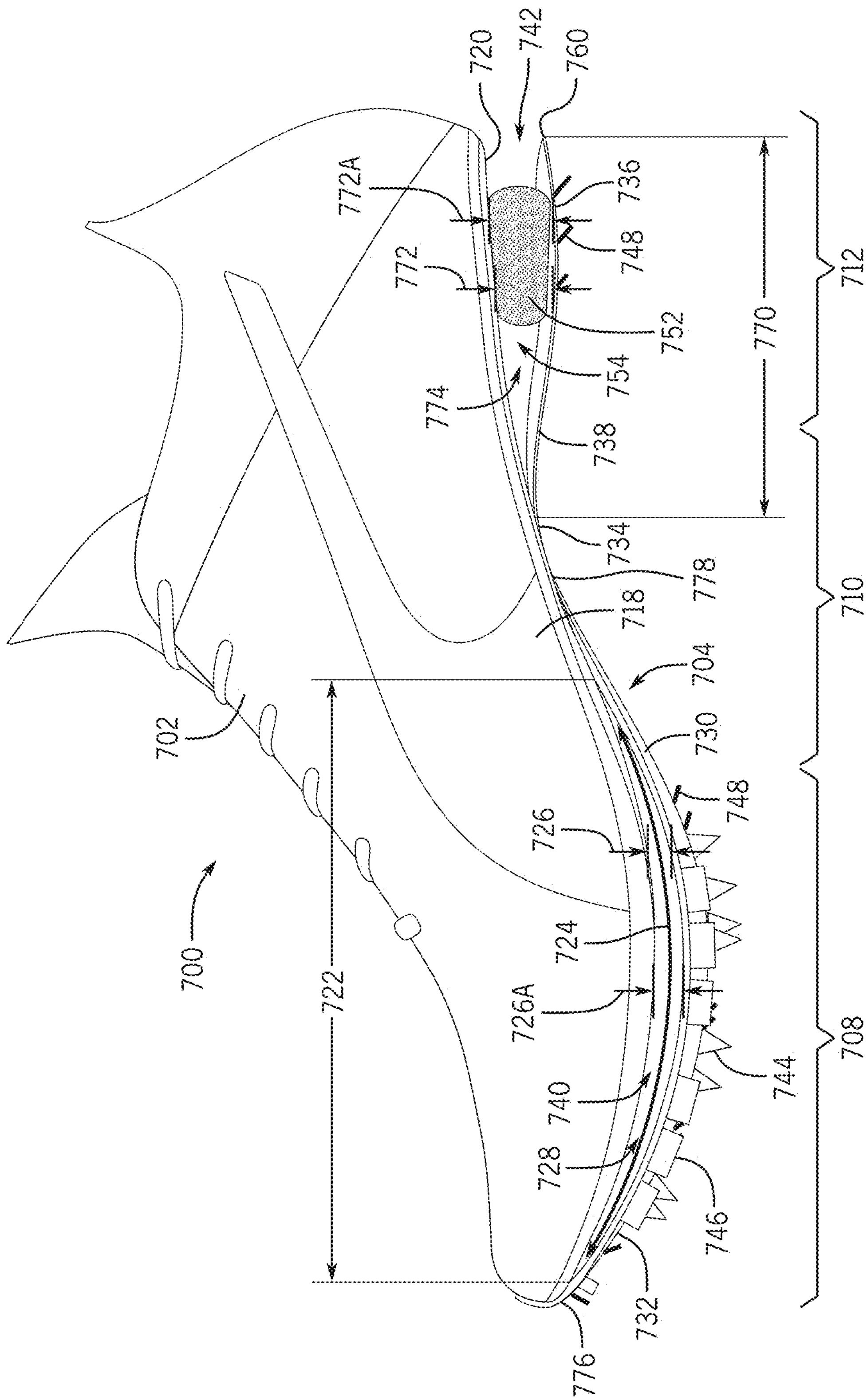
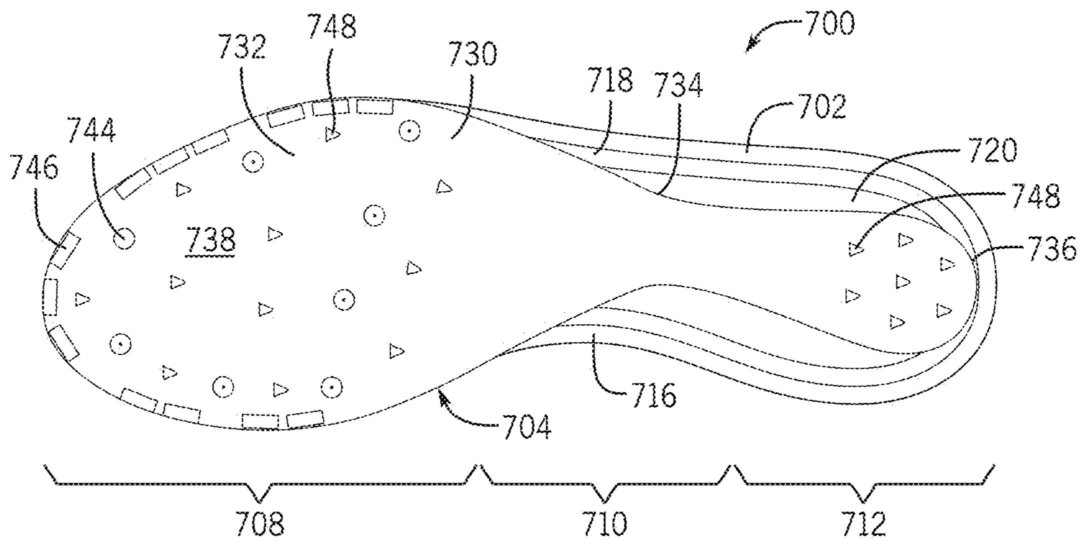
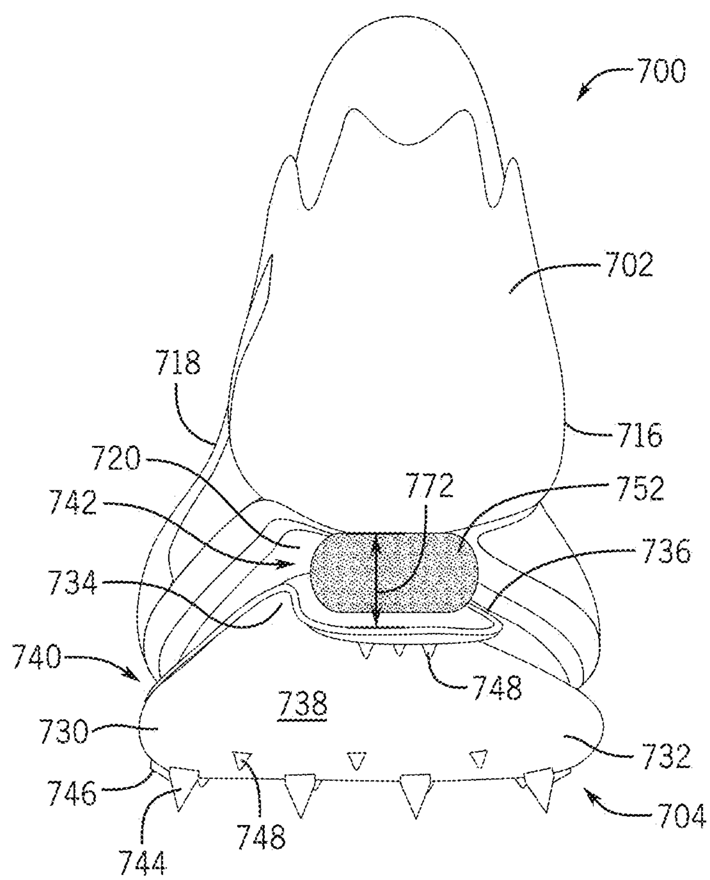

720
742
760
772A
736
748
772
752
754
774
738
770
712
734
778
718
710
704
702
730
748
726
724
700
722
726A
708
744
740
728
746
732
776

FIG. 19



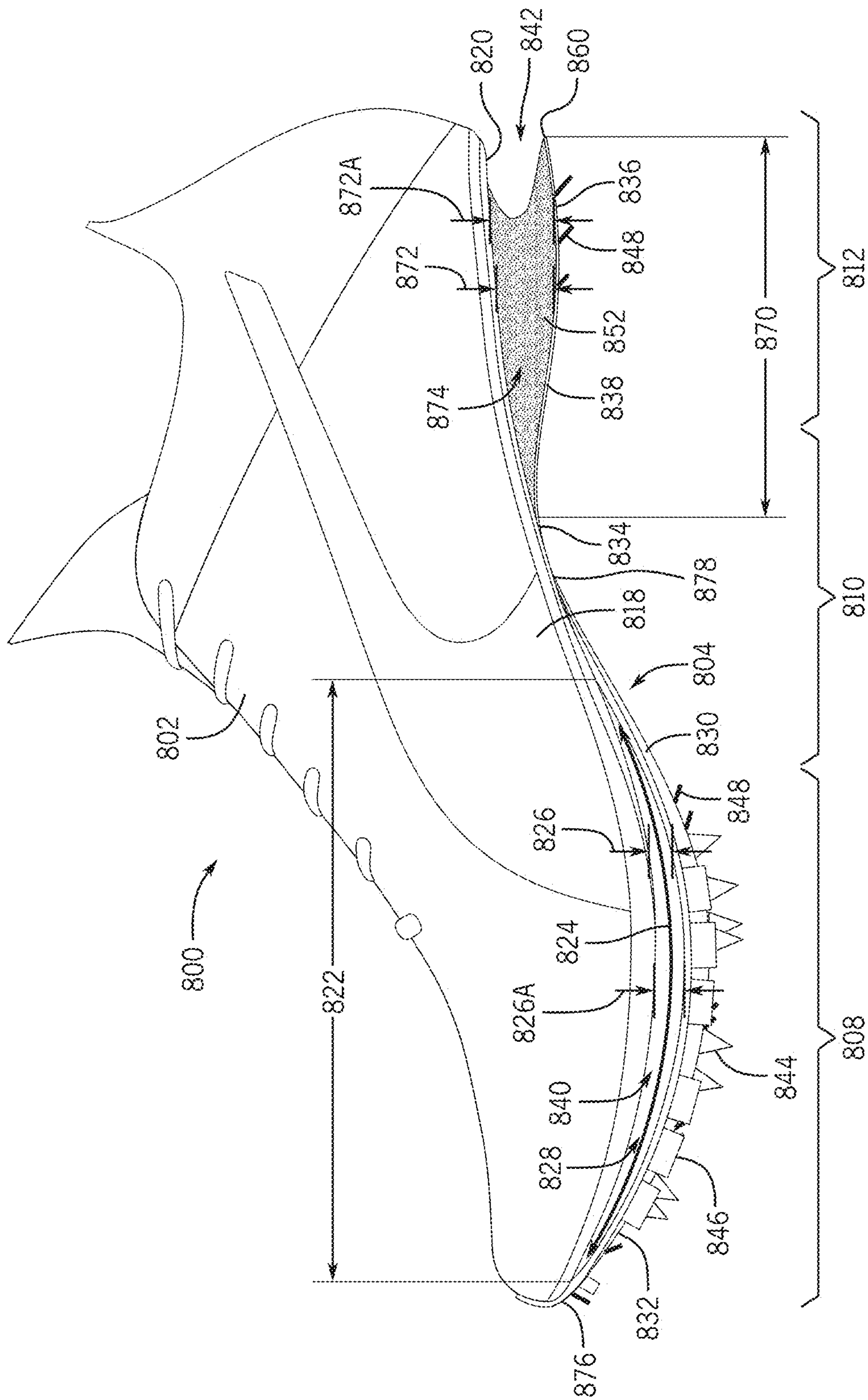
700
748
732
730
718
734
702
744
720
746
748
738
736
716
704
708
710
712

FIG. 20



700
702
718
716
720
772
752
742
736
734
740
748
738
730
732
746
704
748
744

FIG. 21



800
802
804
808
810
812
818
820
822
824
826
826A
828
830
832
834
836
838
840
842
844
846
848
848
852
860
870
872
872A
874
876
878

FIG. 22

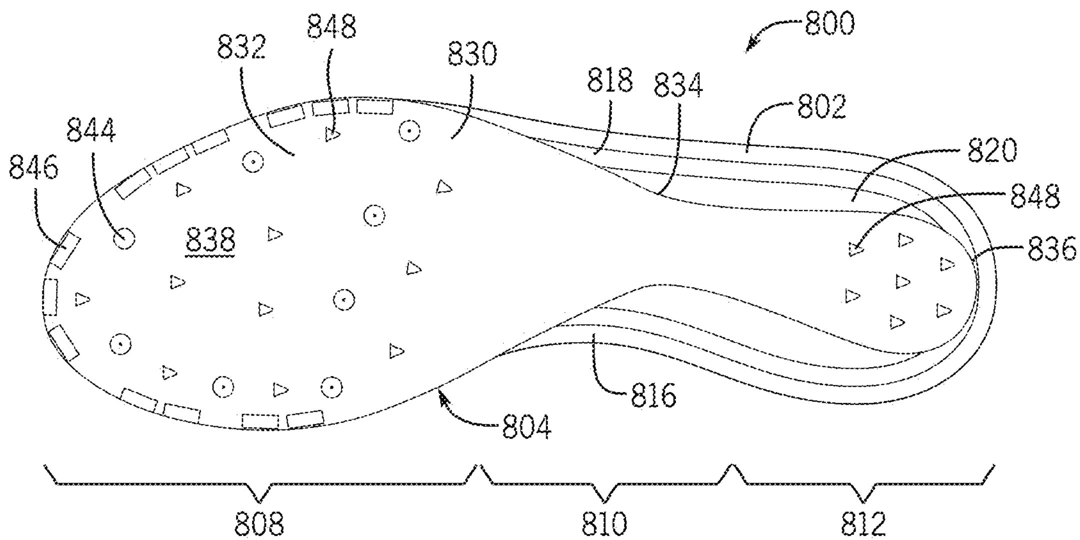

800
832
848
830
818
834
802
844
820
846
848
838
836
816
804
808
810
812

FIG. 23

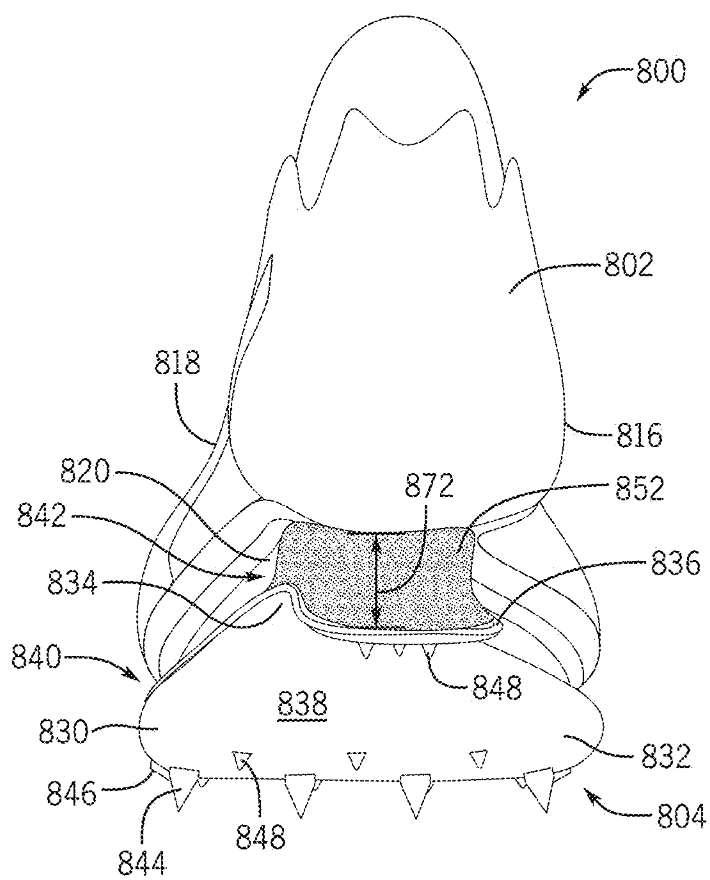

800
802
818
816
820
872
852
842
834
836
840
848
838
830
832
846
804
848
844

FIG. 24

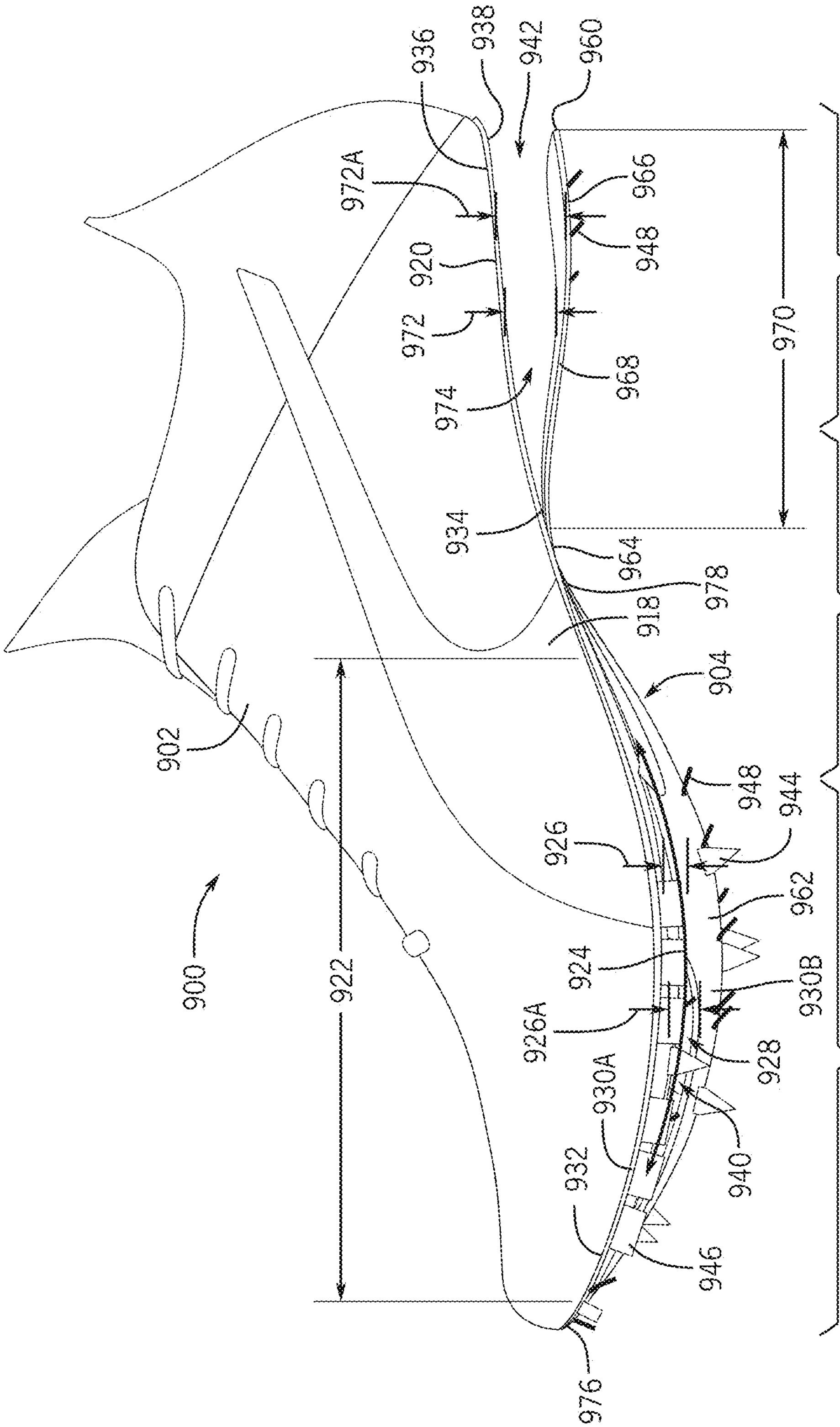

936
938
942
960
972A
966
948
920
972
974
968
970
912
934
964
978
918
910
904
902
948
944
926
962
900
922
924
930B
926A
928
908
930A
940
932
946
976

FIG. 25

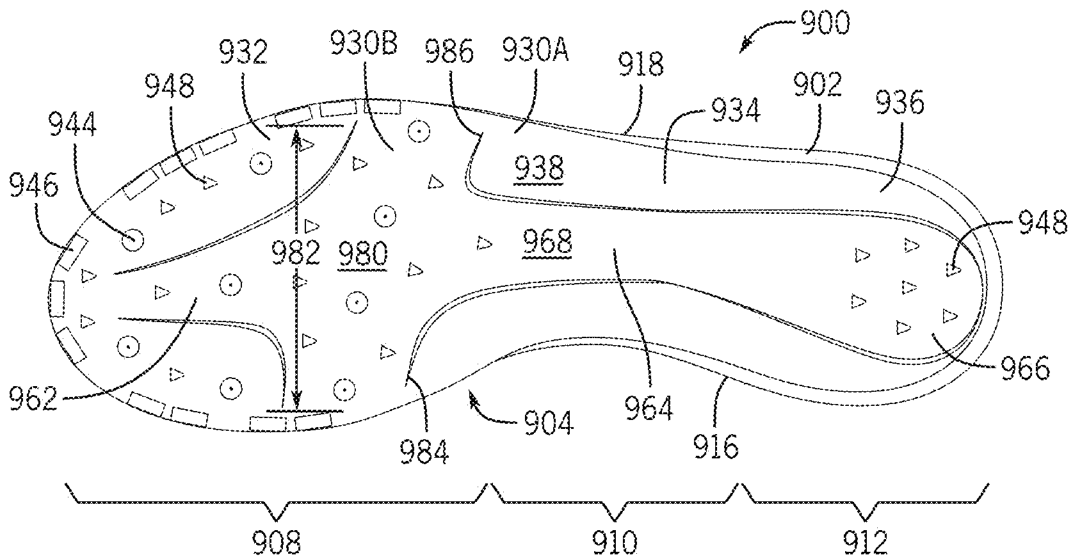

900
932
930B
986
930A
918
934
902
936
948
944
946
938
982
980
968
948
962
984
904
964
916
966
908
910
912

FIG. 26

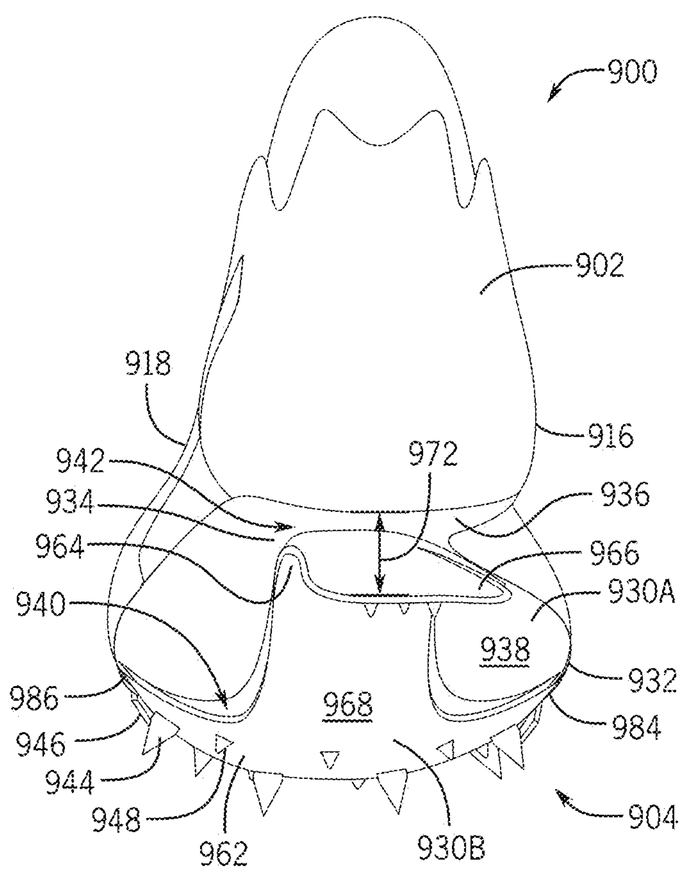

900
902
918
916
942
972
936
934
964
966
940
930A
938
932
986
968
984
946
944
948
962
930B
904

FIG. 27

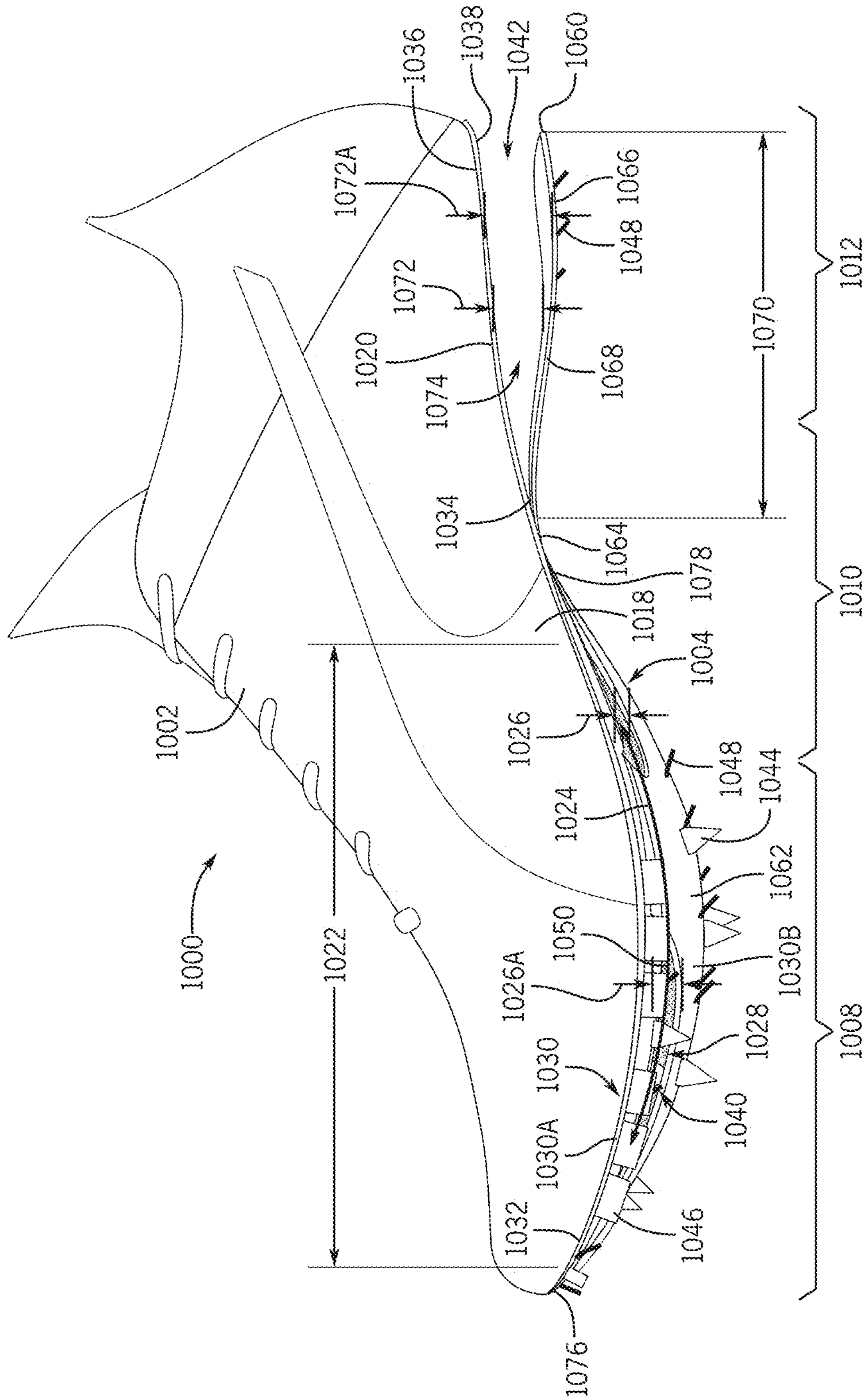

1036
1038
1042
1060
1072A
1066
1048
1012
1072
1020
1074
1068
1070
1034
1064
1078
1010
1018
1004
1002
1026
1048
1024
1044
1062
1000
1022
1050
1030B
1026A
1008
1028
1030
1040
1030A
1046
1032
1076

FIG. 28

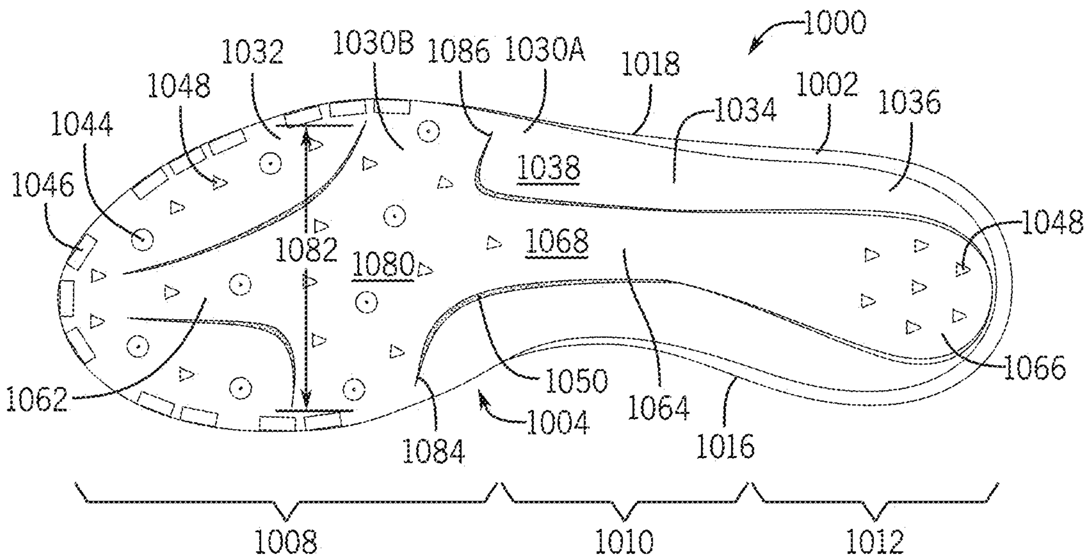

1000
1032
1030B
1086
1030A
1018
1048
1034
1002
1036
1044
1038
1046
1048
1068
1082
1080
1050
1066
1062
1064
1004
1084
1016
1008
1010
1012

FIG. 29

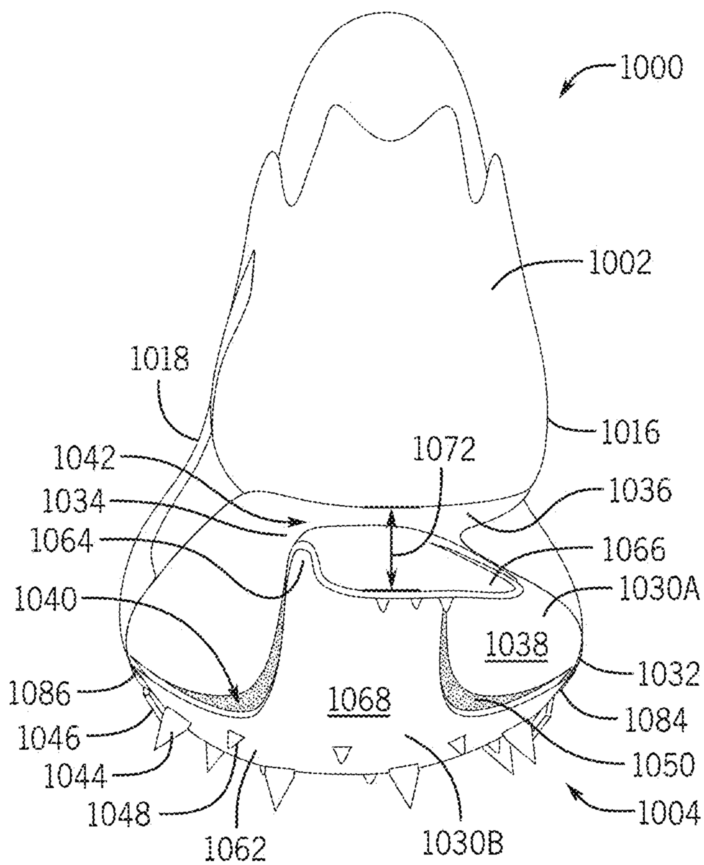

1000
1002
1018
1016
1042
1072
1034
1036
1064
1066
1030A
1040
1038
1032
1086
1068
1084
1046
1050
1044
1004
1048
1062
1030B

FIG. 30

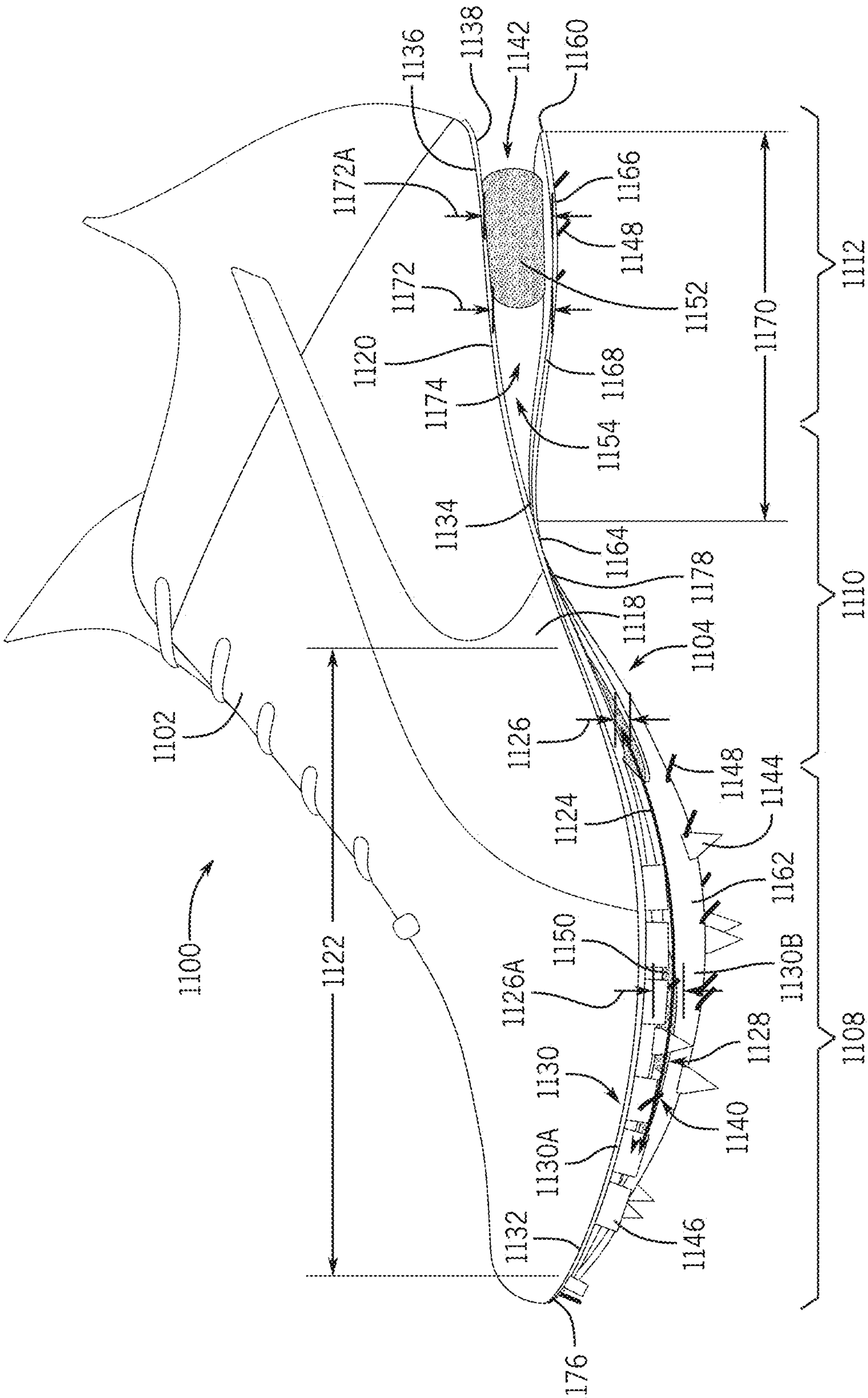
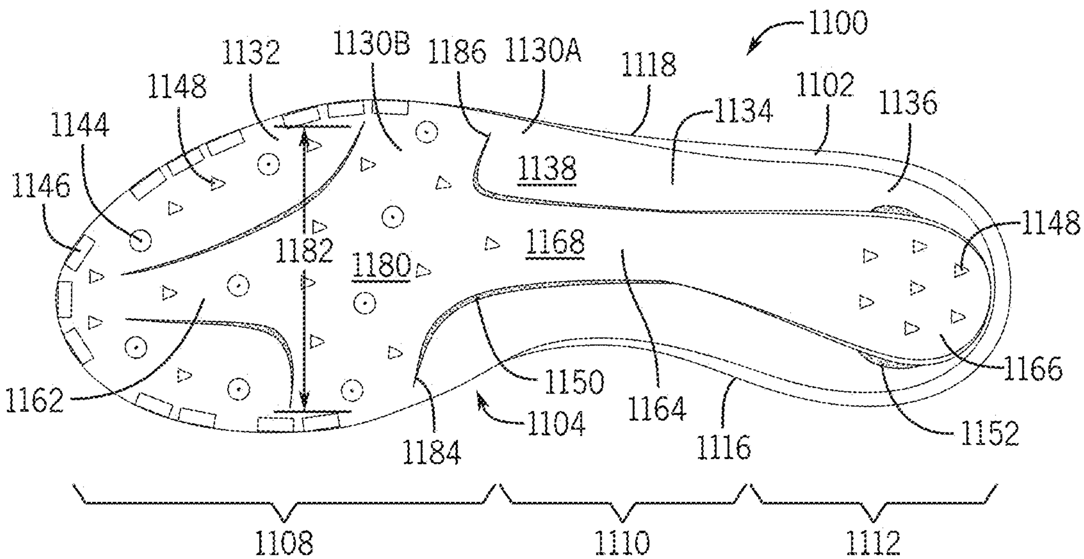
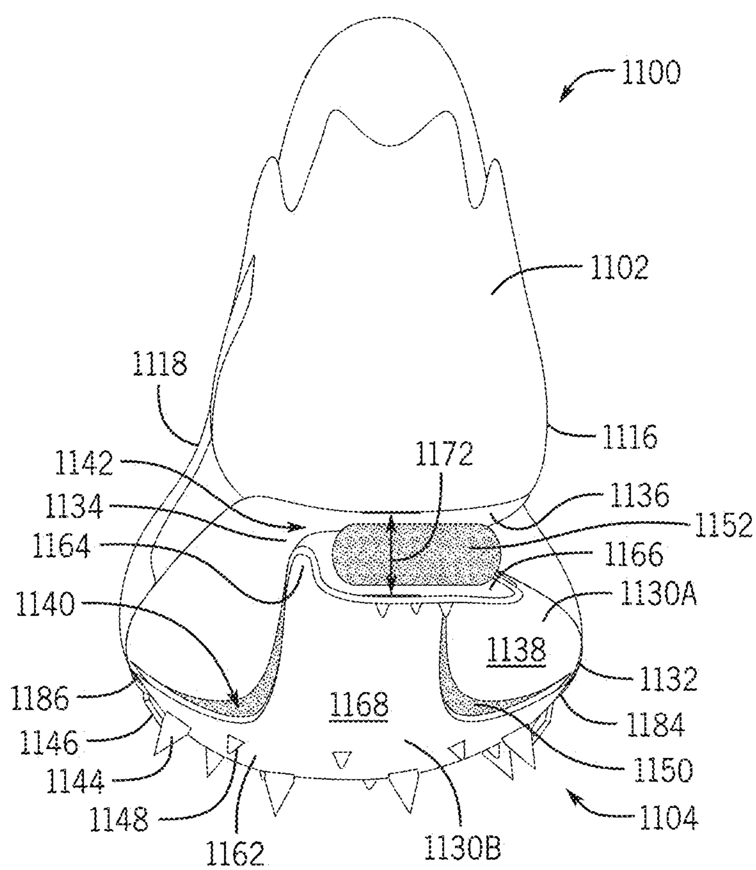

1100
1102
1104
1108
1110
1112
1118
1120
1122
1124
1126
1126A
1128
1130
1130A
1130B
1132
1134
1136
1138
1140
1142
1144
1146
1148
1150
1152
1154
1160
1162
1164
1166
1168
1170
1172
1172A
1174
1176
1178

FIG. 31



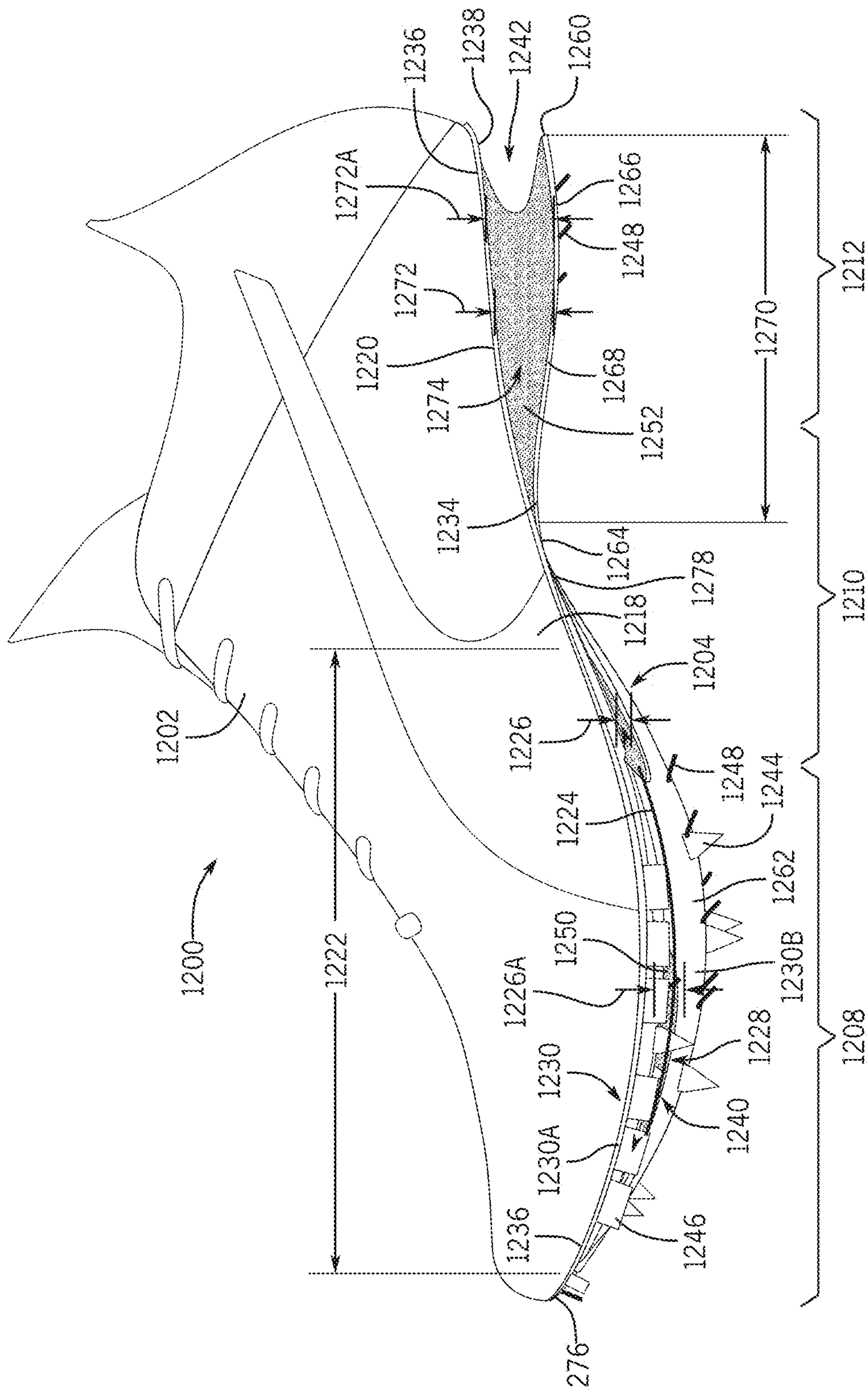
1100
1132
1130B
1186
1130A
1118
1148
1144
1134
1102
1136
1146
1138
1148
1182
1168
1180
1162
1150
1166
1164
1104
1152
1184
1116
1108
1110
1112

FIG. 32



1100
1102
1118
1116
1142
1172
1134
1136
1152
1164
1166
1140
1130A
1138
1132
1186
1168
1184
1146
1150
1144
1148
1104
1162
1130B

FIG. 33


1236
1238
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1260
1272A
1266
1248
1272
1220
1268
1274
1252
1270
1212
1234
1264
1278
1218
1210
1204
1202
1226
1248
1244
1224
1262
1200
1222
1250
1230B
1226A
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1208
1230
1240
1230A
1236
1246
1276

FIG. 34

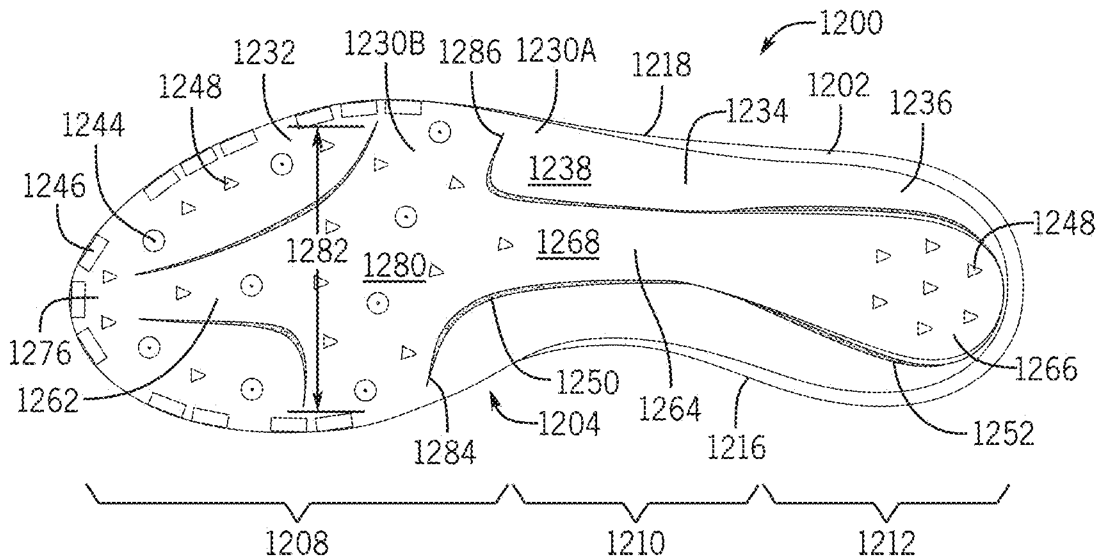
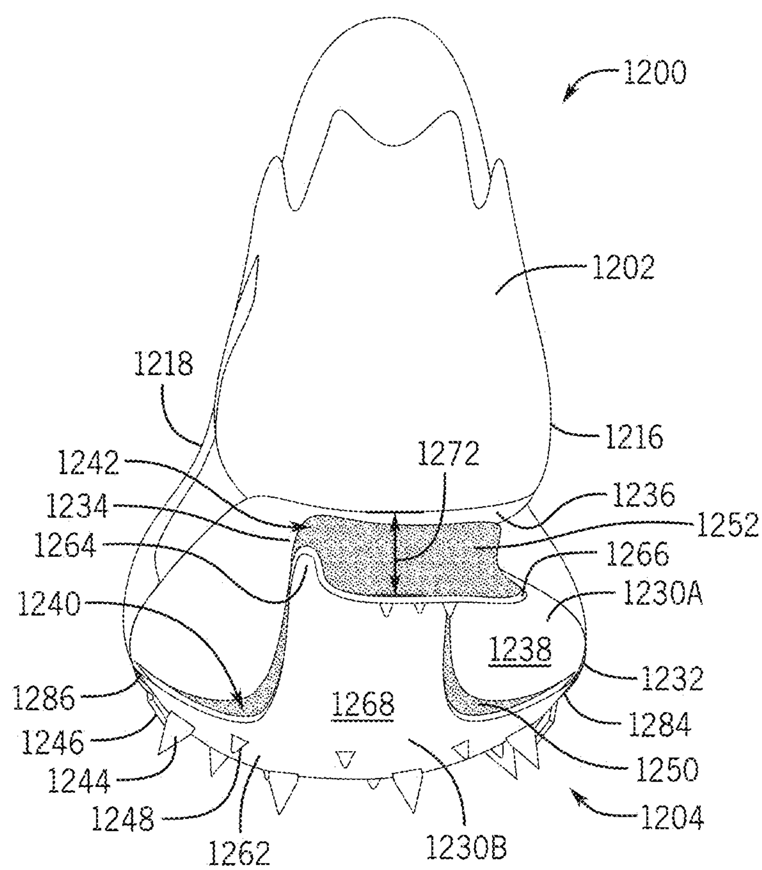

1200
1232
1230B
1286
1230A
1218
1202
1234
1236
1248
1244
1246
1238
1282
1280
1268
1248
1276
1262
1250
1264
1266
1204
1284
1216
1252
1208
1210
1212

FIG. 35


1200
1202
1218
1216
1242
1272
1234
1236
1252
1264
1266
1240
1230A
1238
1286
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1232
1284
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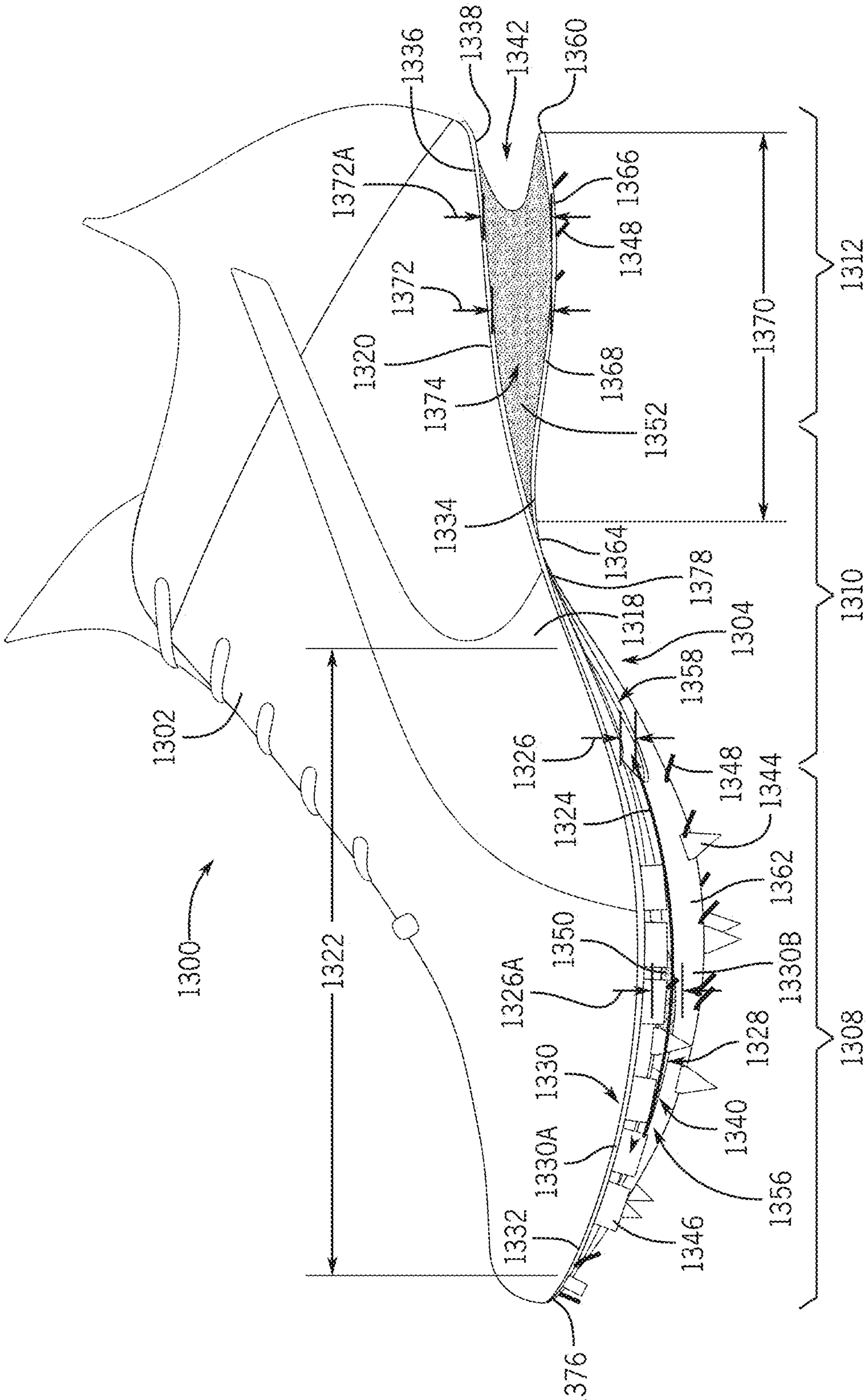
1250
1244
1248
1204
1262
1230B

FIG. 36


1336
1338
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1360
1372A
1366
1348
1312
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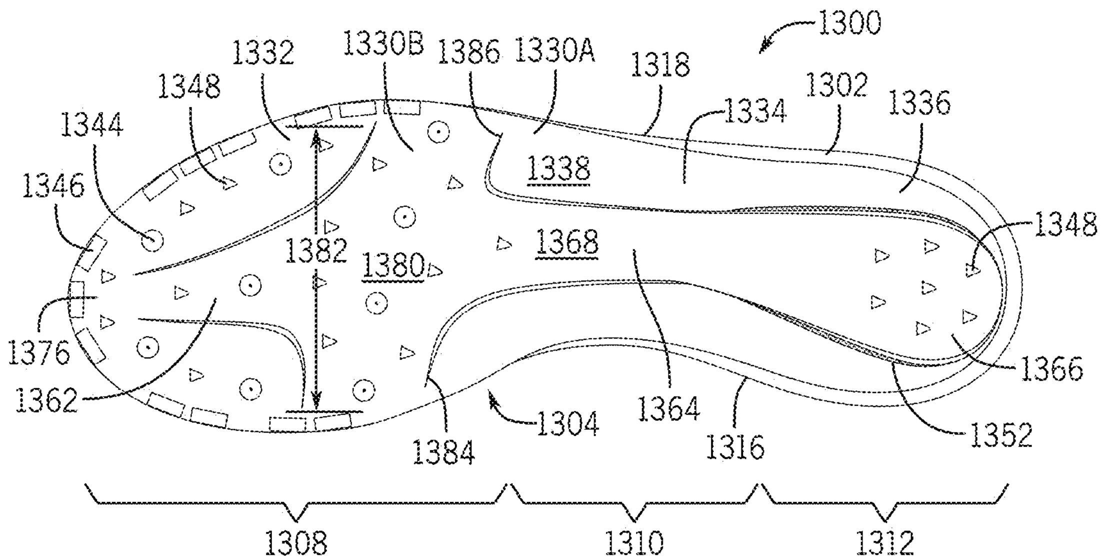
1320
1368
1374
1352
1334
1364
1378
1310
1318
1304
1358
1302
1326
1348
1344
1324
1362
1300
1322
1350
1330B
1326A
1328
1308
1330
1340
1330A
1356
1332
1346
1376

FIG. 37


1300
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1330B
1386
1330A
1318
1348
1302
1336
1334
1344
1338
1346
1348
1382
1368
1380
1376
1366
1362
1304
1364
1384
1352
1316
1308
1310
1312

FIG. 38

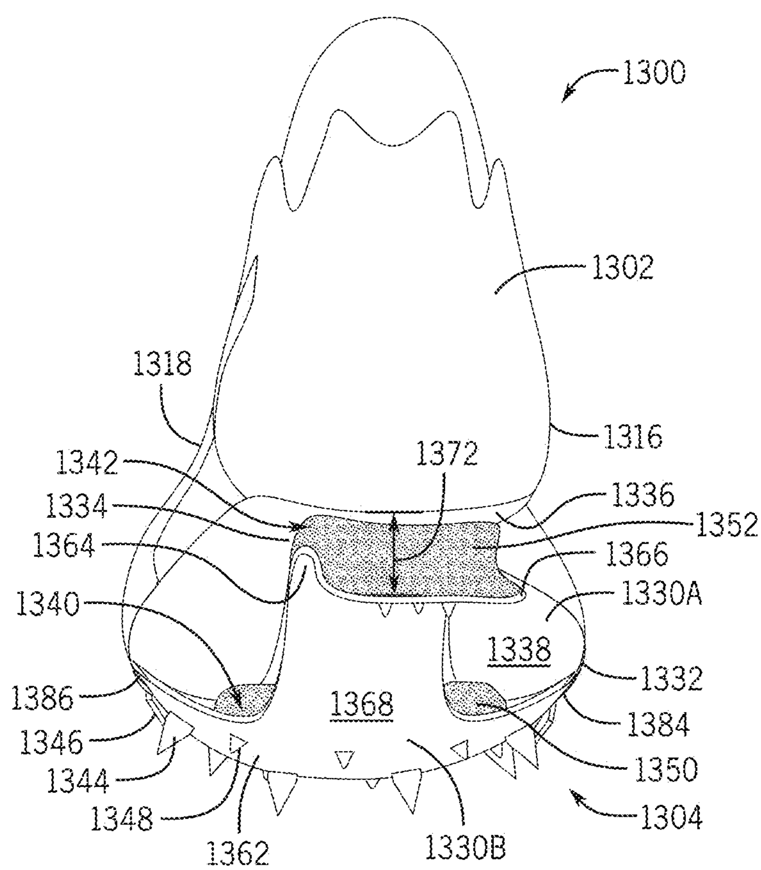

1300
1302
1318
1316
1342
1372
1334
1336
1352
1364
1366
1340
1330A
1338
1332
1386
1368
1384
1346
1350
1344
1348
1304
1362
1330B

FIG. 39

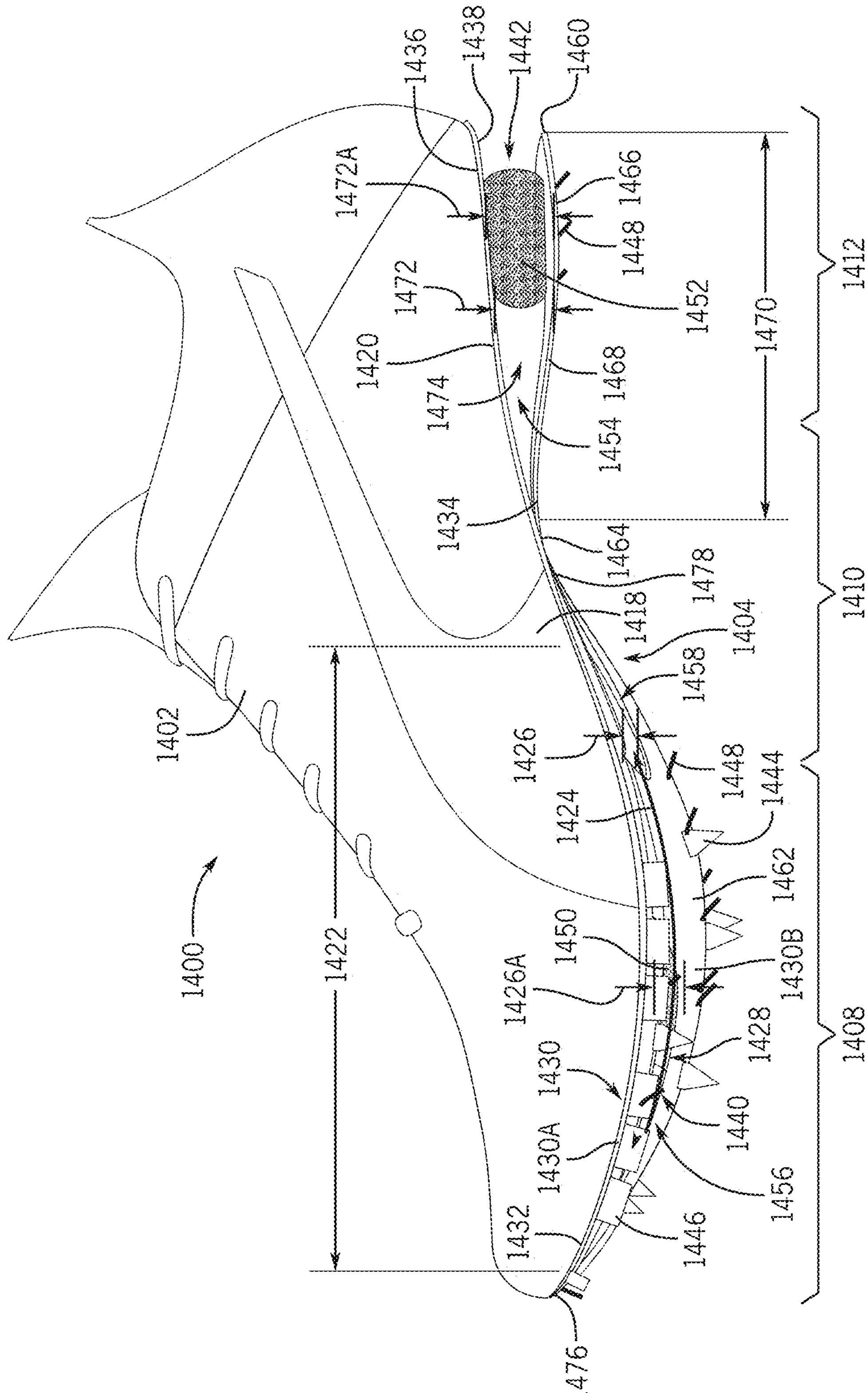
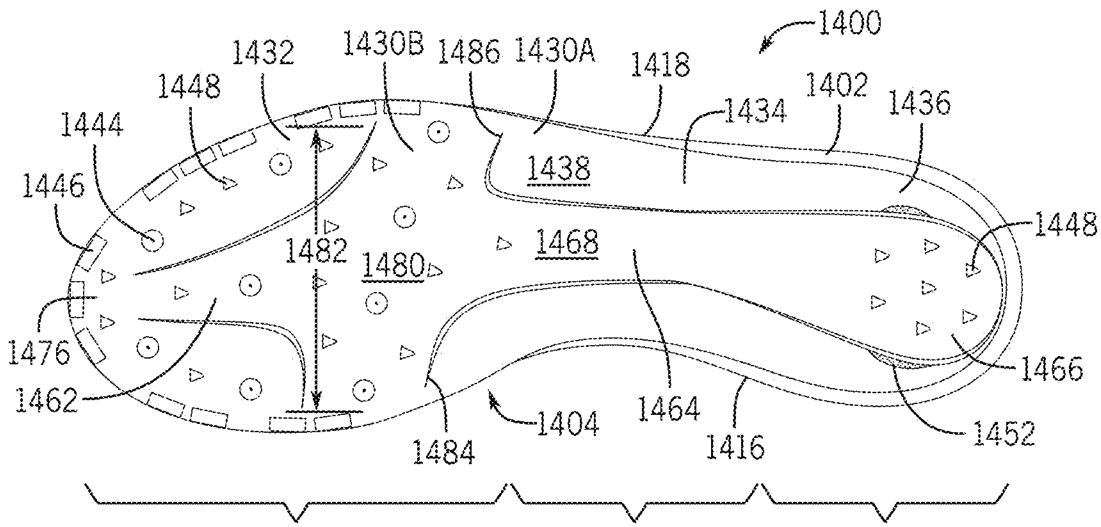
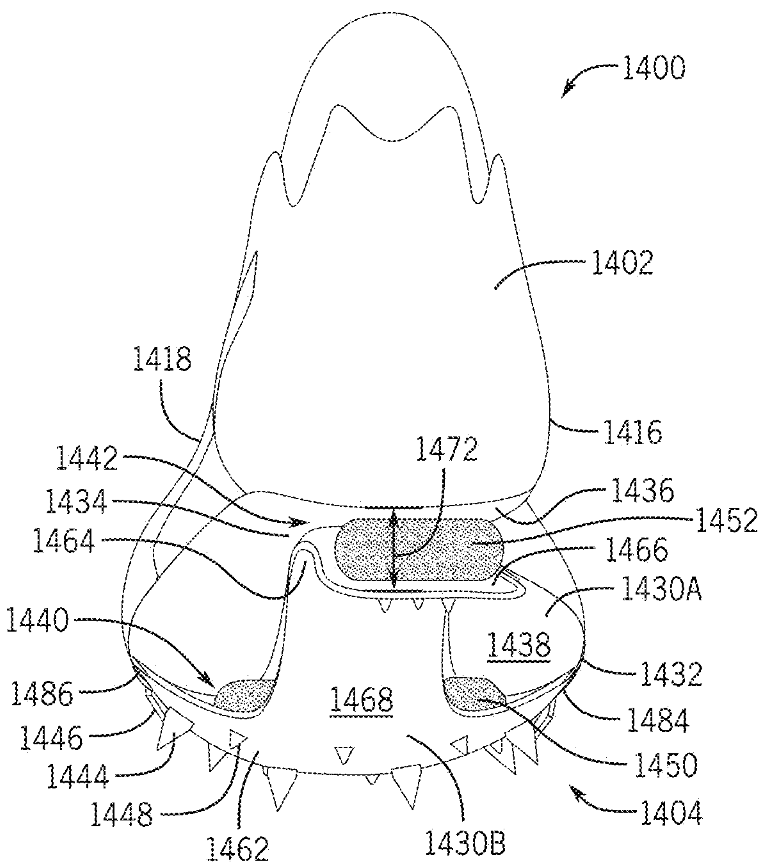

1400
1402
1404
1408
1410
1412
1418
1420
1422
1424
1426
1426A
1428
1430
1430A
1430B
1432
1434
1436
1438
1440
1442
1444
1446
1448
1450
1452
1454
1456
1458
1460
1462
1464
1466
1468
1470
1472
1472A
1474
1476
1478

FIG. 40



1400
1432
1430B
1486
1430A
1418
1448
1434
1402
1436
1444
1438
1446
1448
1482
1468
1480
1476
1466
1462
1404
1464
1452
1484
1416
1408
1410
1412

FIG. 41



1400
1402
1418
1416
1442
1472
1436
1434
1452
1464
1466
1430A
1440
1438
1486
1468
1432
1484
1446
1450
1444
1404
1448
1462
1430B

FIG. 42

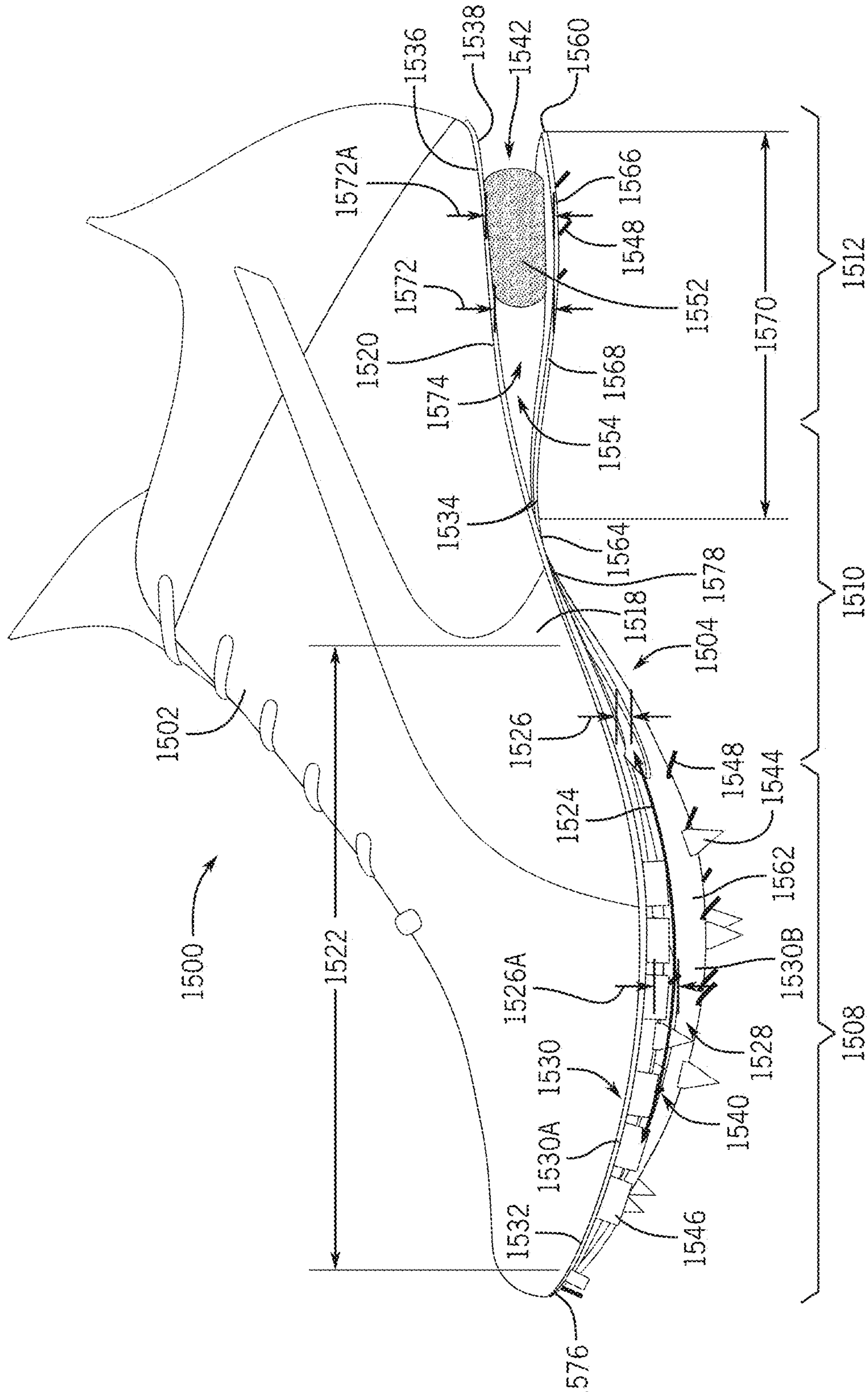

1500
1502
1504
1508
1510
1512
1518
1520
1522
1524
1526
1526A
1528
1530
1530A
1530B
1532
1534
1536
1538
1540
1542
1544
1546
1548
1548
1552
1554
1560
1562
1564
1566
1568
1570
1572
1572A
1574
1576
1578

FIG. 43

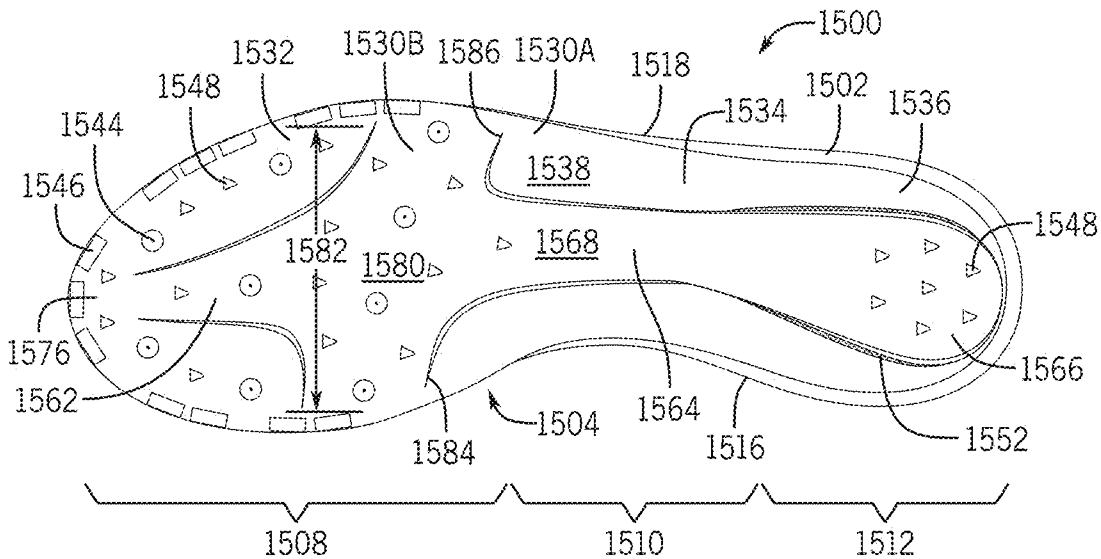

1500
1532
1530B
1586
1530A
1518
1548
1502
1534
1536
1544
1538
1546
1548
1582
1568
1580
1576
1566
1562
1504
1564
1584
1516
1552
1508
1510
1512

FIG. 44

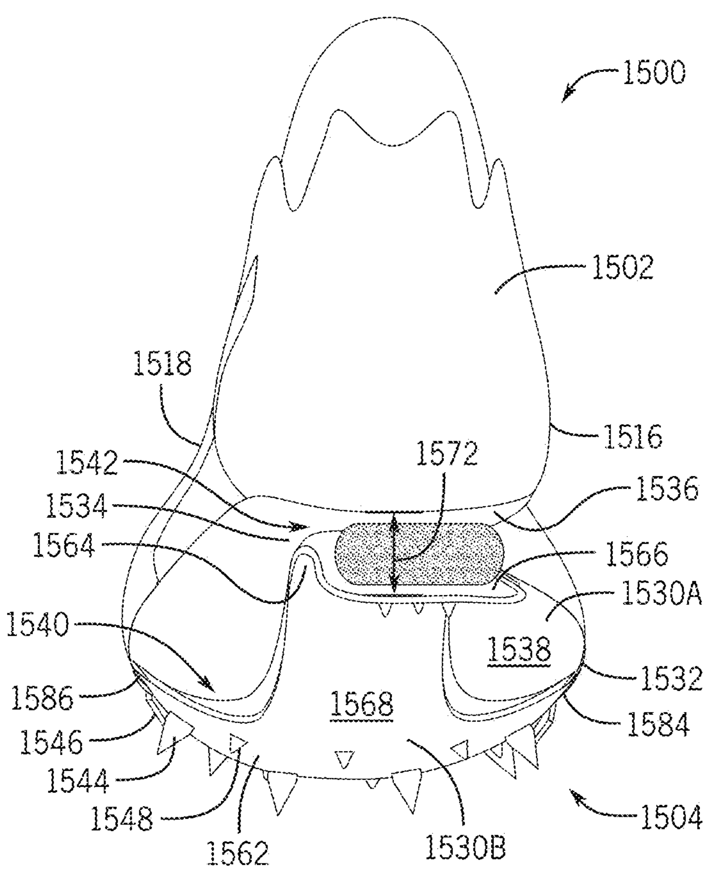

1500
1502
1518
1516
1542
1572
1536
1534
1564
1566
1530A
1540
1538
1532
1586
1568
1584
1546
1544
1548
1504
1562
1530B

FIG. 45

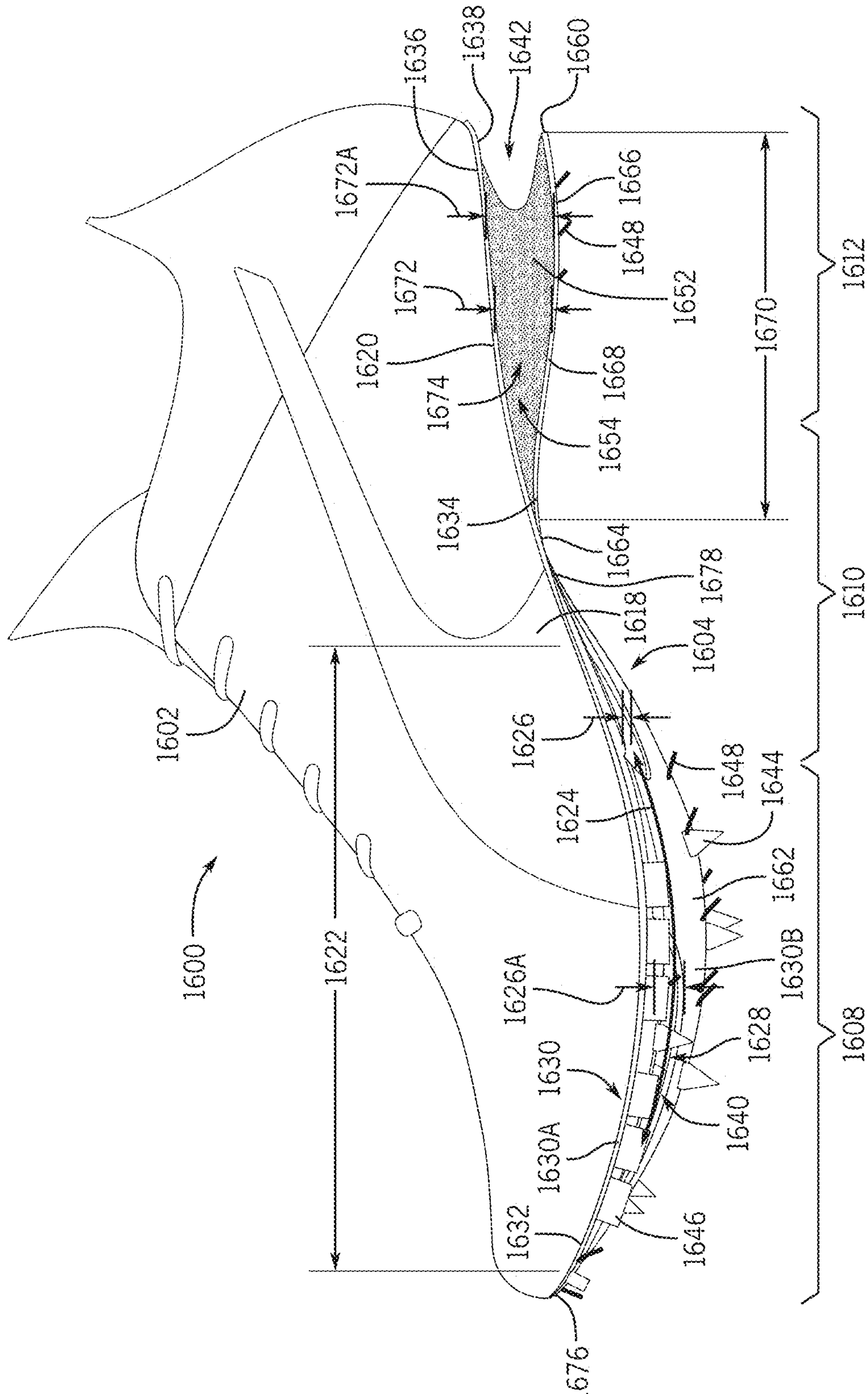

1600
1602
1604
1608
1610
1612
1618
1620
1622
1624
1626
1626A
1628
1630
1630A
1630B
1632
1634
1636
1638
1640
1642
1644
1646
1648
1652
1654
1660
1662
1664
1666
1668
1670
1672
1672A
1674
1676
1678

FIG. 46

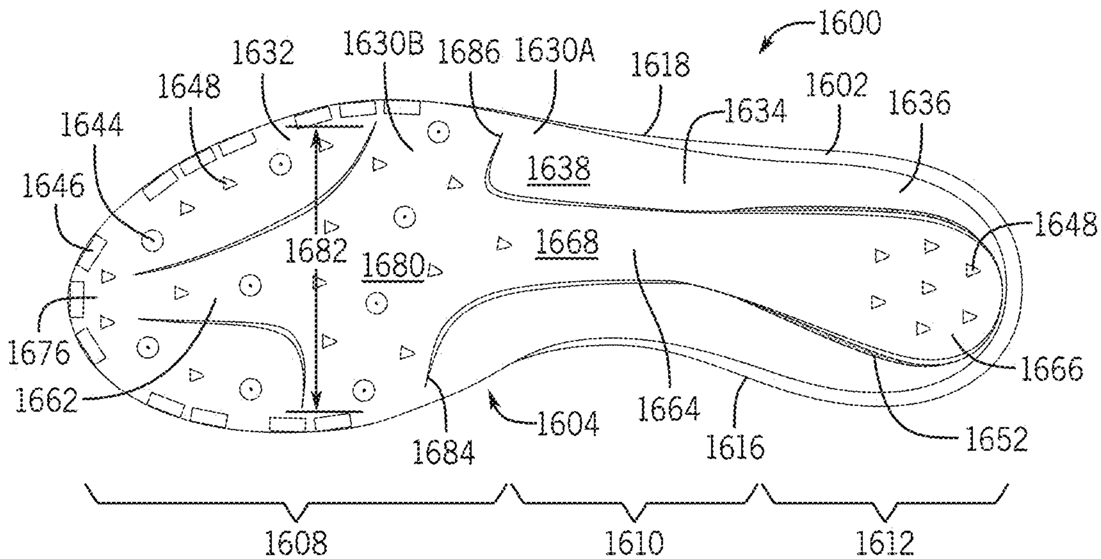

1600
1632
1630B
1686
1630A
1618
1648
1634
1602
1636
1644
1638
1646
1648
1682
1668
1680
1676
1666
1662
1604
1664
1684
1616
1652
1608
1610
1612

FIG. 47

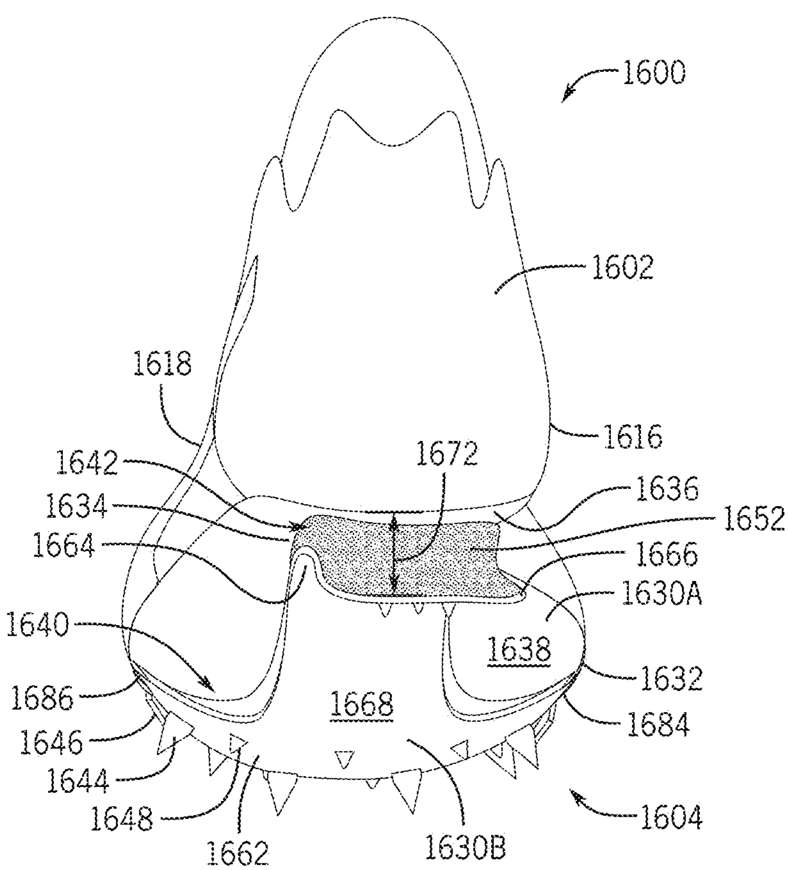

1600
1602
1618
1616
1642
1672
1636
1634
1652
1664
1666
1630A
1640
1638
1632
1686
1668
1684
1646
1644
1604
1648
1662
1630B

FIG. 48

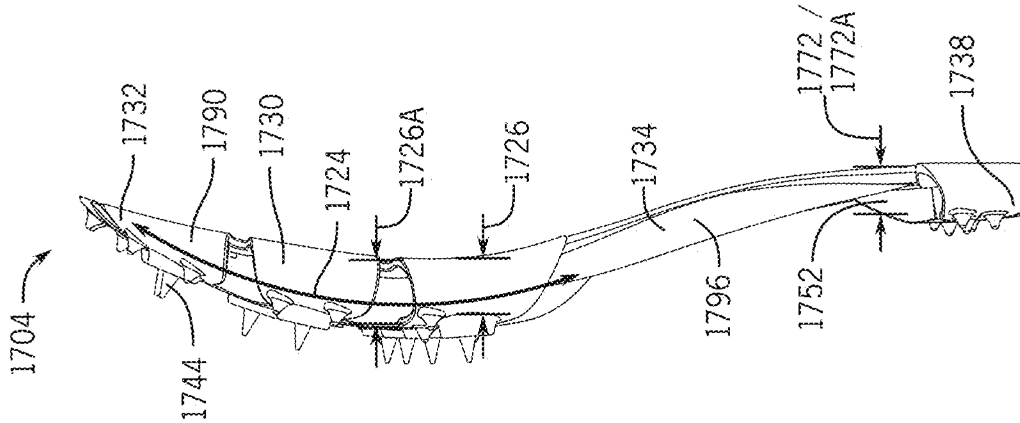


FIG. 51

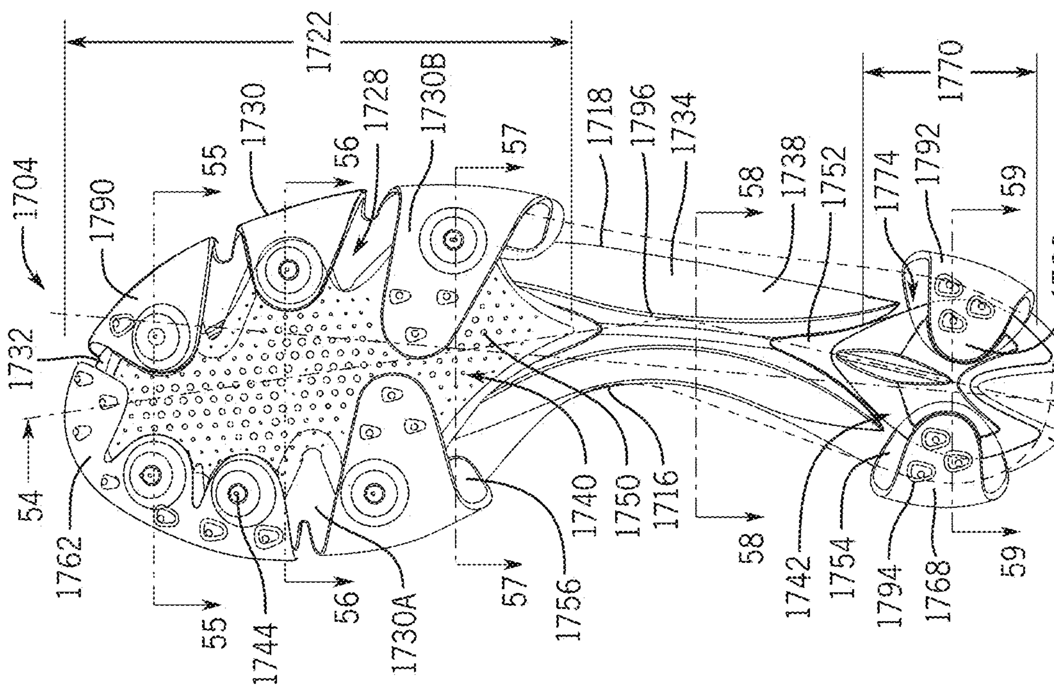


FIG. 50

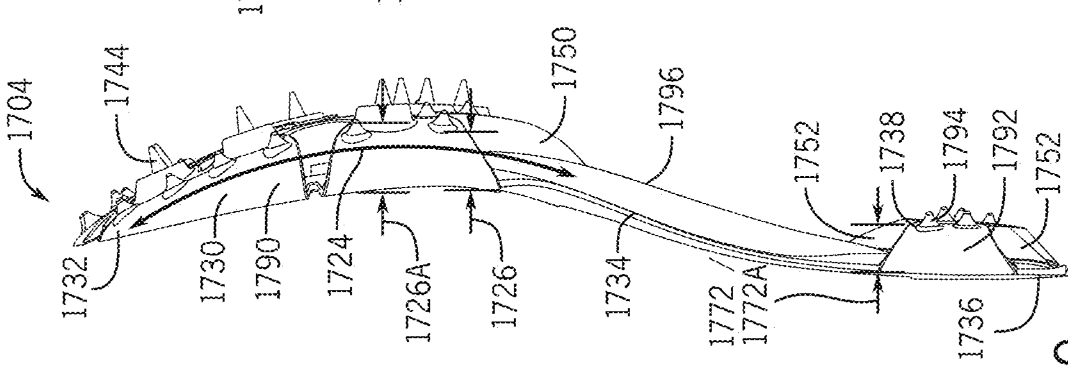
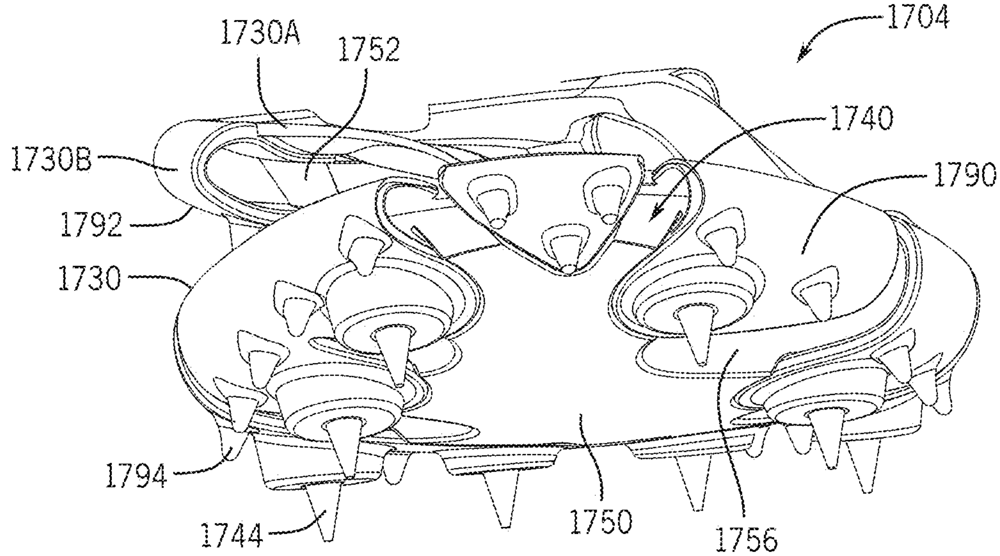
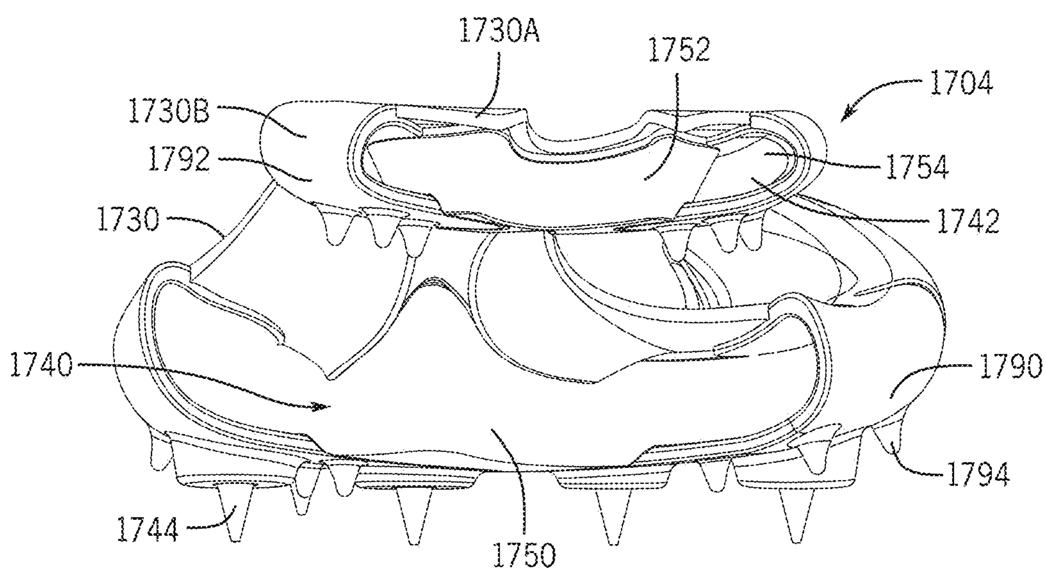


FIG. 49



1704
1730A
1752
1740
1730B
1790
1792
1730
1794
1744
1750
1756

FIG. 52



1730A
1752
1704
1730B
1792
1754
1742
1730
1740
1790
1794
1744
1750

FIG. 53

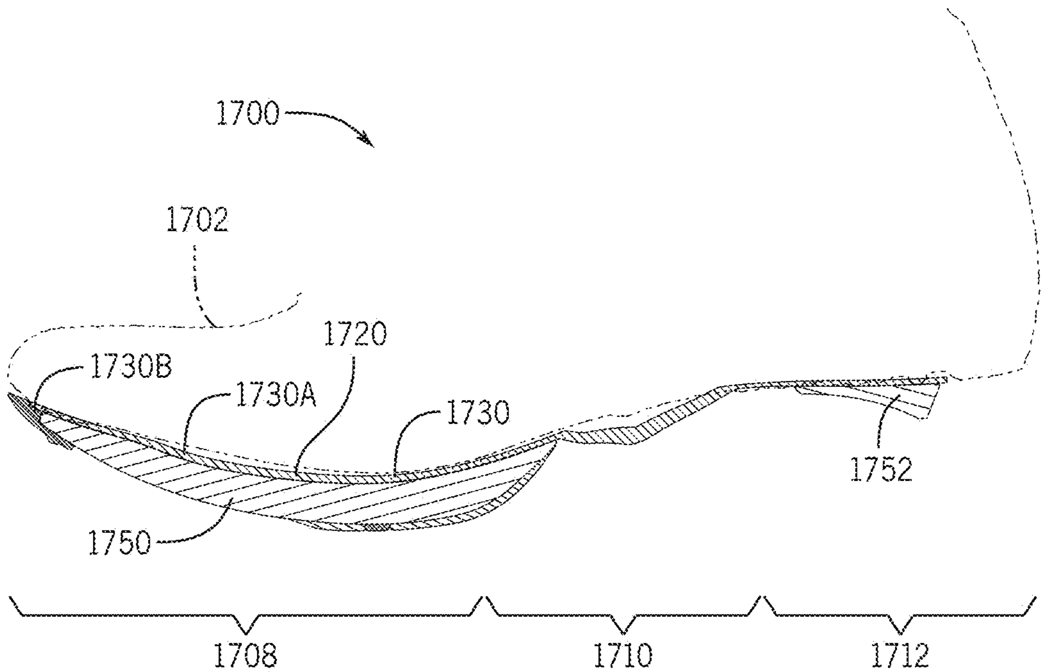

1700
1702
1720
1730B
1730A
1730
1752
1750
1708
1710
1712

FIG. 54

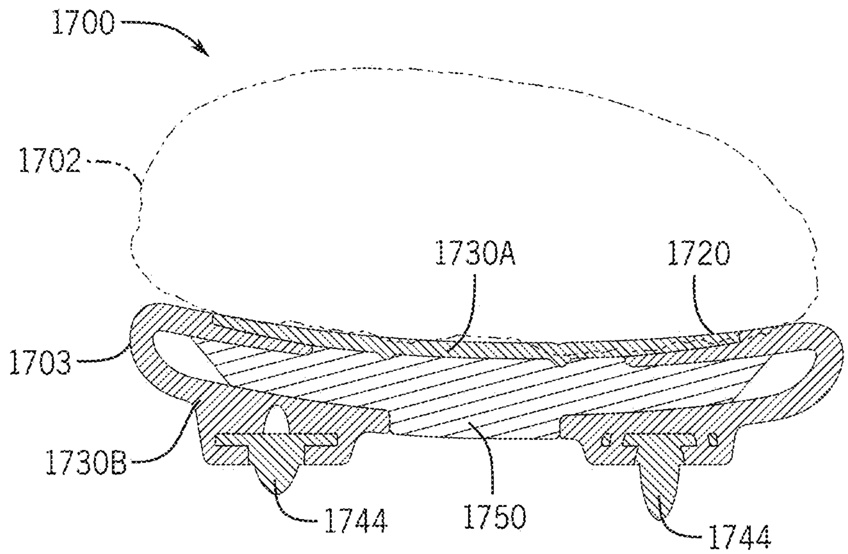

1700
1702
1730A
1720
1703
1730B
1744
1750
1744

FIG. 55

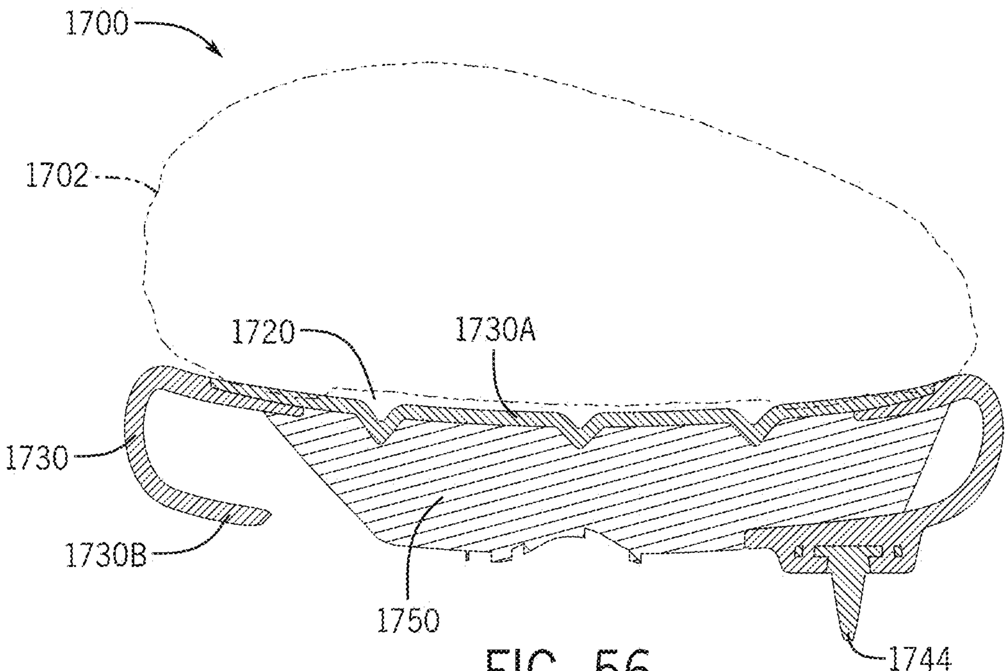
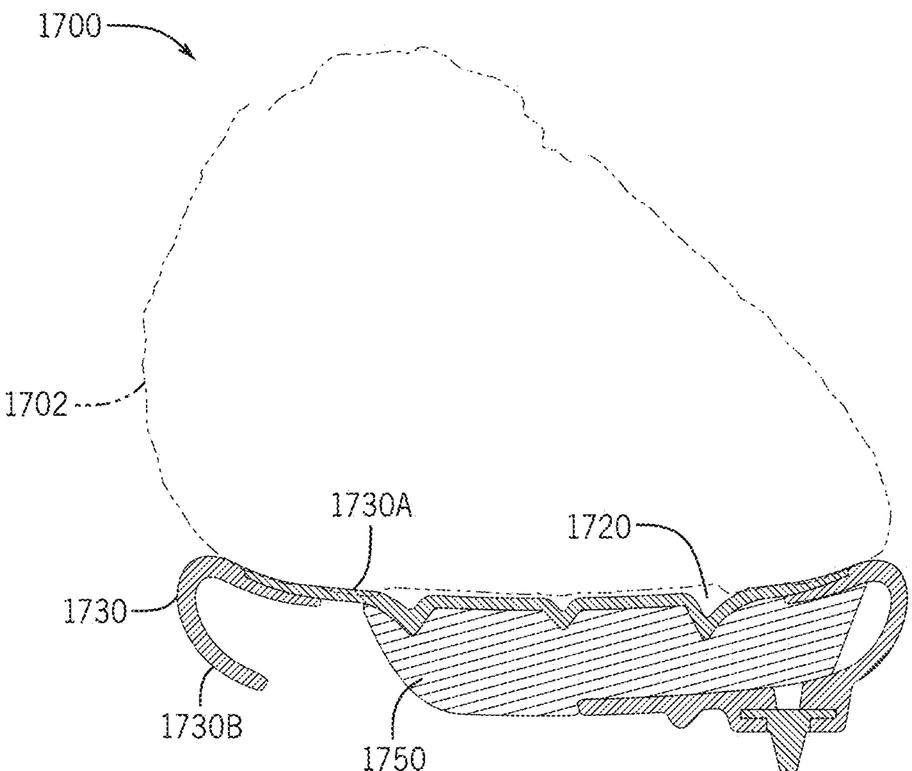

1700
1702
1720
1730A
1730
1730B
1750
1744

FIG. 56


1700
1702
1730A
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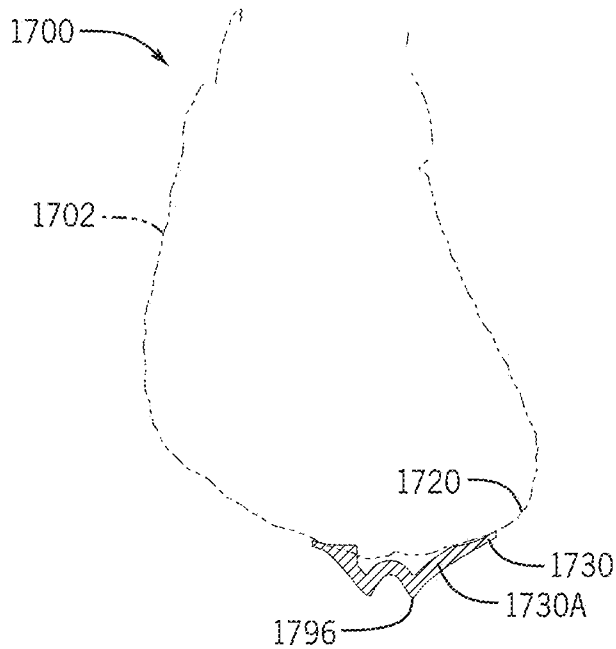
1730
1730B
1750
1744

FIG. 57


1700
1702
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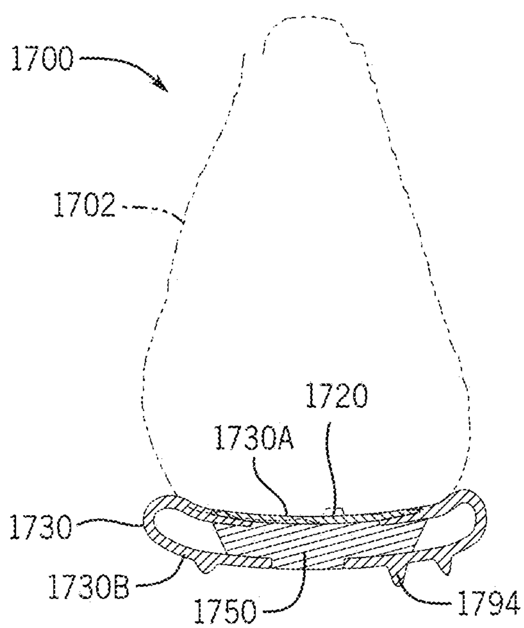
1730
1730A
1796

FIG. 58


1700
1702
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1730A
1730
1730B
1750
1794

FIG. 59

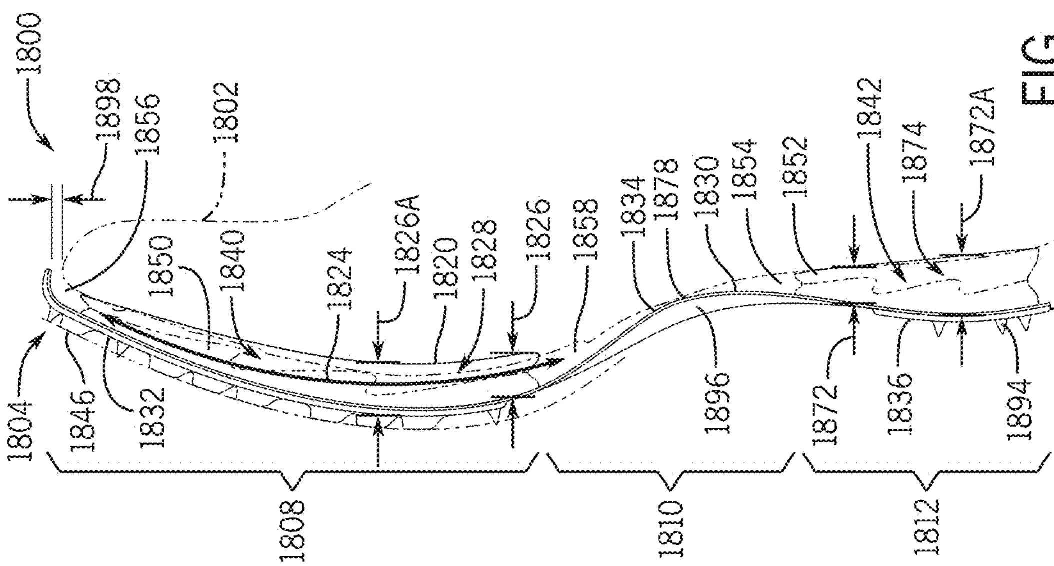


FIG. 62

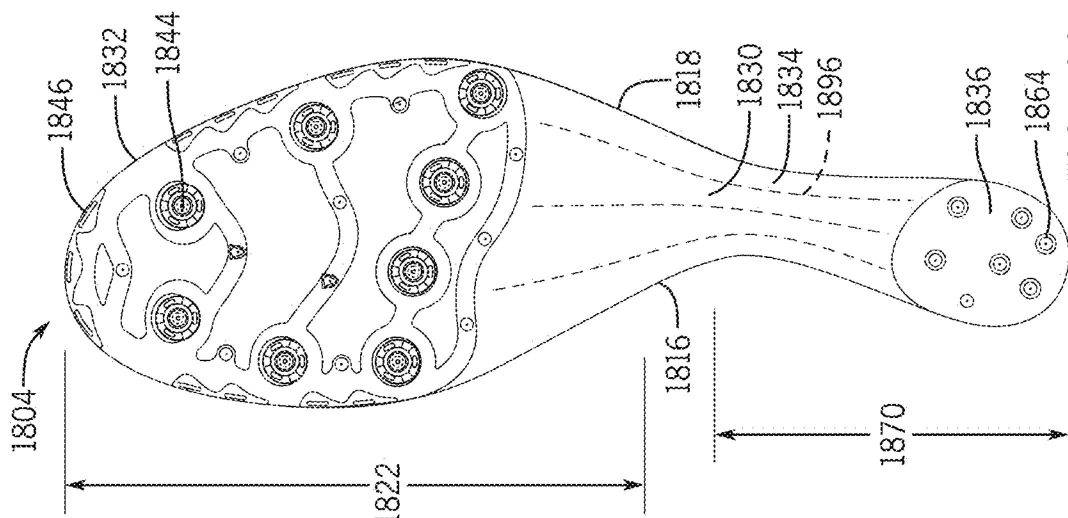


FIG. 61

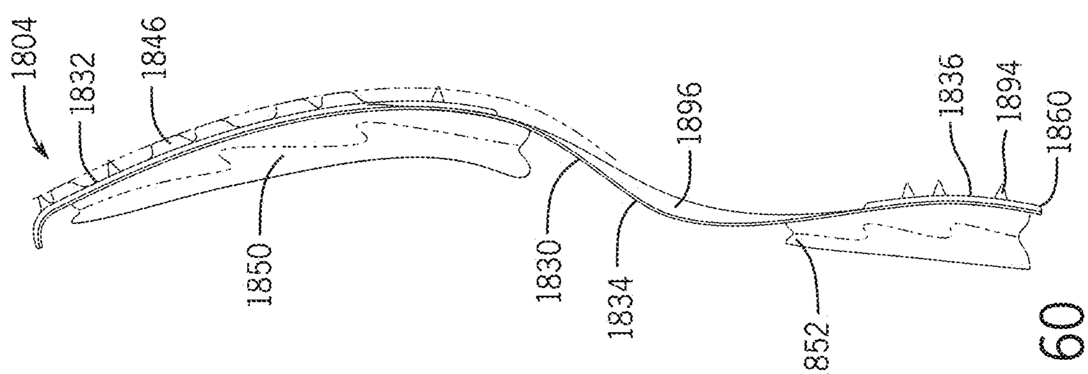


FIG. 60

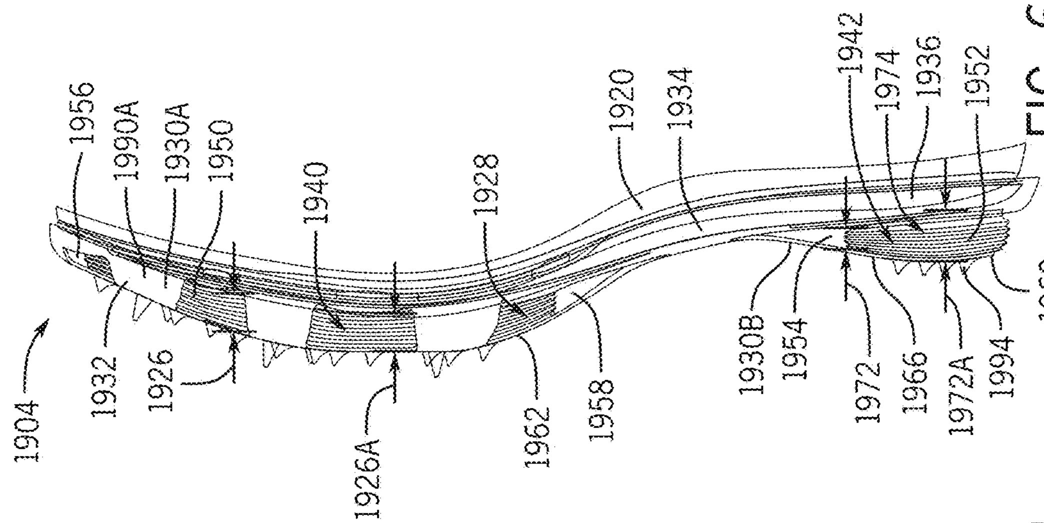


FIG. 65

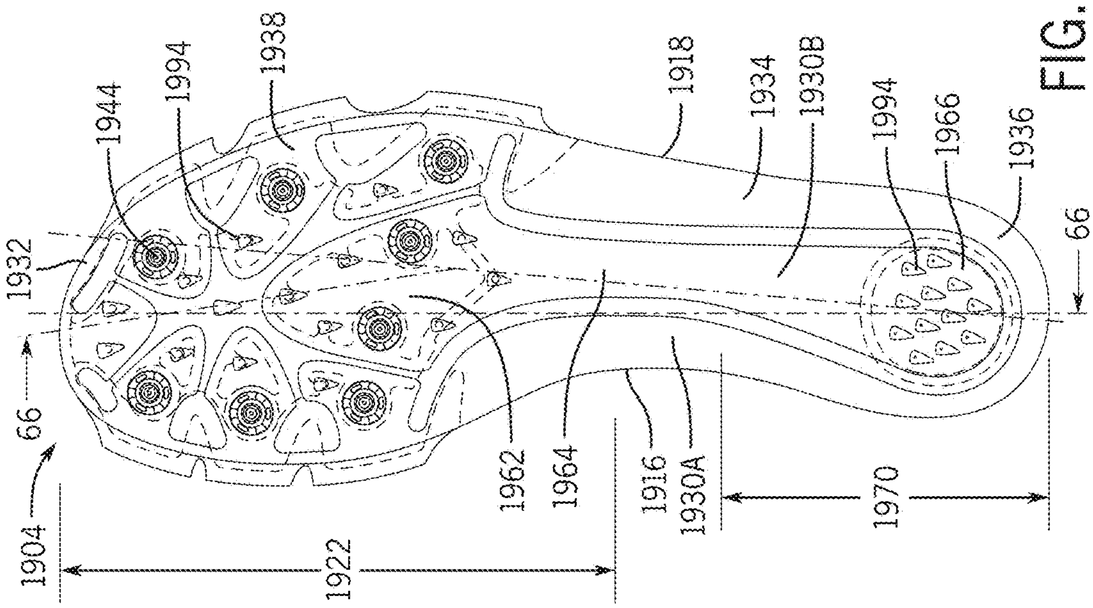


FIG. 64

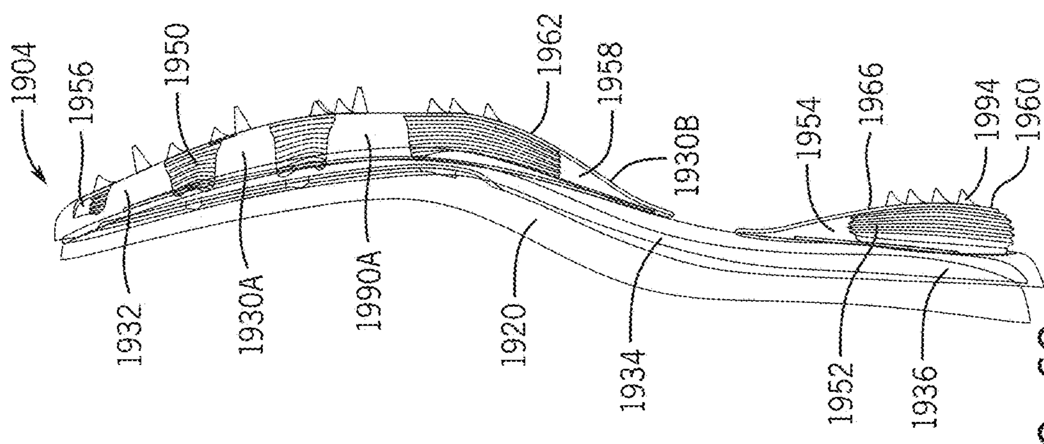
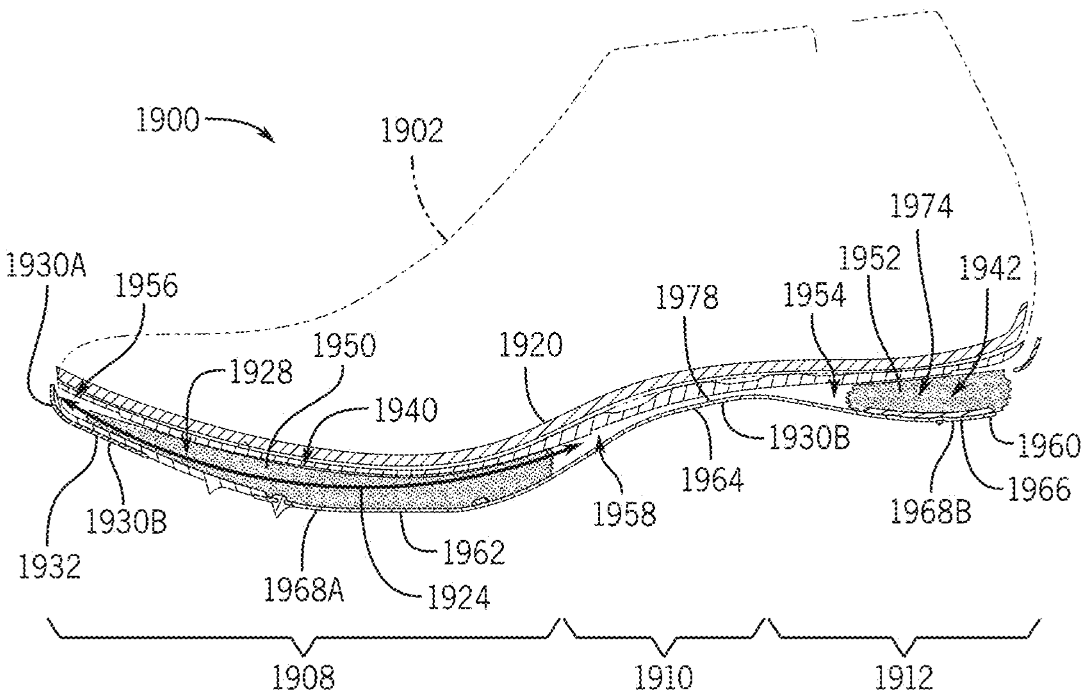


FIG. 63



1900
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1942
1930A
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1978
1954
1950
1920
1928
1940
1930B
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1964
1966
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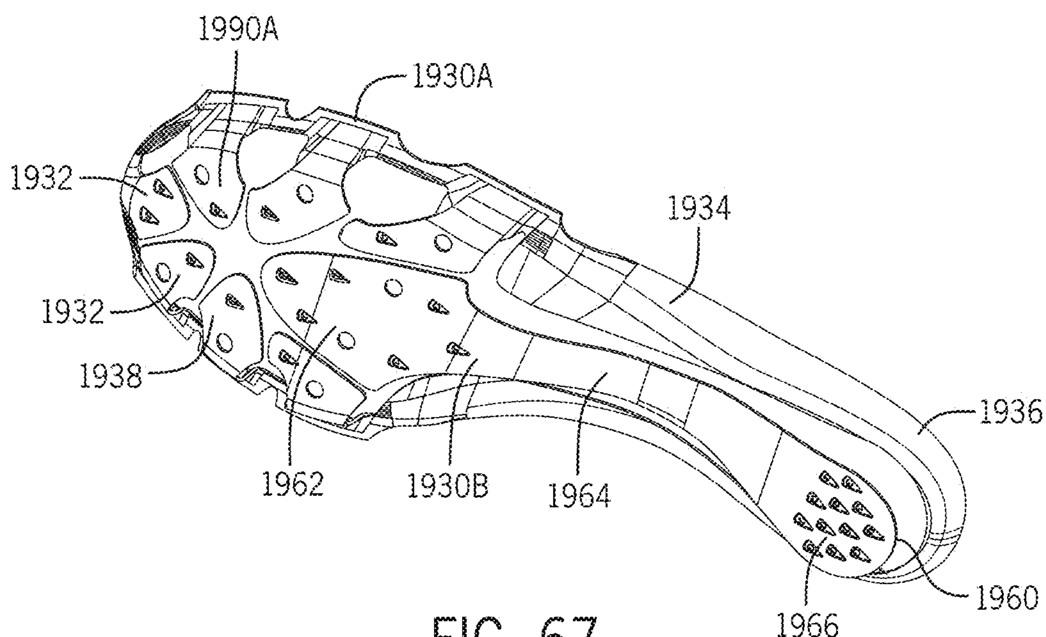
1968B
1930B
1962
1932
1968A
1924
1908
1910
1912

FIG. 66



1990A
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1938
1936
1962
1930B
1964
1960
1966

FIG. 67

ARTICLE OF FOOTWEAR HAVING A SOLE PLATE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 18/109,991, filed on Feb. 15, 2023, which is a continuation of U.S. patent application Ser. No. 17/218,353, filed on Mar. 31, 2021, which claims priority to U.S. Provisional Application Ser. No. 63/139,447, filed on Jan. 20, 2021, the contents of which is incorporated by reference herein in its entirety and is to be considered a part of this application.

REFERENCE REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

SEQUENCE LISTING

Not applicable

BACKGROUND

1. Field of the Invention

The present disclosure relates generally to an article of footwear including a sole plate.

2. Description of the Background

Many conventional shoes or other articles of footwear generally comprise an upper and a sole attached to a lower end of the upper. Conventional shoes further include an internal space, i.e., a void or cavity, which is created by interior surfaces of the upper and sole, that receives a foot of a user before securing the shoe to the foot. The sole is attached to a lower surface or boundary of the upper and is positioned between the upper and the ground. As a result, the sole typically provides stability and cushioning to the user when the shoe is being worn. In some instances, the sole may include multiple components, such as an outsole, a midsole, and a top portion. The outsole may provide traction to a bottom surface of the sole, and the midsole may be attached to an inner surface of the outsole, and may provide cushioning or added stability to the sole. For example, a sole may include a particular foam material that may increase stability at one or more desired locations along the sole, or a foam material that may reduce stress or impact energy on the foot or leg when a user is running, walking, or engaged in another activity. The sole may also include additional components, such as plates, embedded with the sole to increase the overall stiffness of the sole and reduce energy loss during use.

The upper generally extends upward from the sole and defines an interior cavity that completely or partially encases a foot. In most cases, the upper extends over the instep and toe regions of the foot, and across medial and lateral sides thereof. Many articles of footwear may also include a tongue that extends across the instep region to bridge a gap between edges of medial and lateral sides of the upper, which define an opening into the cavity. The tongue may also be disposed below a lacing system and between medial and lateral sides of the upper, to allow for adjustment of shoe tightness. The tongue may further be manipulatable by a user to permit

entry or exit of a foot from the internal space or cavity. In addition, the lacing system may allow a user to adjust certain dimensions of the upper or the sole, thereby allowing the upper to accommodate a wide variety of foot types having varying sizes and shapes.

The upper of many shoes may comprise a wide variety of materials, which may be utilized to form the upper and chosen for use based on one or more intended uses of the shoe. The upper may also include portions comprising varying materials specific to a particular area of the upper. For example, added stability may be desirable at a front of the upper or adjacent a heel region so as to provide a higher degree of resistance or rigidity. In contrast, other portions of a shoe may include a soft woven textile to provide an area with stretch-resistance, flexibility, air-permeability, or moisture-wicking properties.

However, in many cases, articles of footwear having uppers with an increased comfort and better fit are desired, along with soles having improved cushioning systems or structural characteristics such as a sole plate to add rigidity or spring-like properties.

SUMMARY

An article of footwear, as described herein, may have various configurations. The article of footwear may have an upper and a sole structure connected to the upper.

According to one aspect of the disclosure, an article of footwear can include an upper and a sole structure coupled to the upper. The sole structure can define a ground engaging surface, and can include a cushioning member coupled to the upper and an outsole coupled to the cushioning member. The outsole can include a central portion and a plurality of lobes extending outward from a periphery of the central portion. Each of the plurality of lobes can be independently movable relative to one another.

In some embodiments, the outsole can include a plurality of ground engaging elements. The plurality of ground engaging elements can include a plurality of removable spikes and a plurality of barbs that can be integrally formed with the outsole. Each of the plurality of removable spikes include a conical tip and each of the plurality of barbs has a triangular pyramidal shape. In some cases, each of the plurality of lobes can include a single removable spike of the plurality of removable spikes and at least one barb of the plurality of barbs.

In some embodiments, the plurality of lobes can include a first plurality of lobes arranged along a medial side of the sole structure and a second plurality of lobes arranged along a lateral side of the sole structure. Each of the first plurality of lobes and the second plurality of lobes can include three lobes. A first lobe of the first plurality of lobes can be positioned directly across the central portion from a second lobe of the second plurality of lobes. The first lobe and the second lobe can extend in opposite directions from one another at their respective connections with the central portion. In some cases, the plurality of lobes can be positioned in a forefoot region of the sole structure. The outsole can define an open area between the first plurality of lobes and the second plurality of lobes. The cushioning member can extend through the open area to define a portion of the ground engaging surface.

In some embodiments, the outsole can be configured as a rigid plate that can include a first portion in a forefoot region of the sole structure, a second portion in a midfoot region of the sole structure, and a third portion in a heel region of the sole structure. The first portion can extend across the fore-

foot region from a lateral side of the sole structure to a medial side of the sole structure. The second portion can extend partially across the sole structure from the lateral side to the medial side. The third portion can extend partially across the sole structure from the lateral side to the medial side. In some cases, the second portion of the outsole can include a rib protruding from a bottom surface of the outsole. The rib can extend in a direction between the first portion and the second portion of the outsole.

In some embodiments, the cushioning member can be a supercritical foam having pockets of gas therein. In some cases, the gas can be nitrogen.

According to another aspect of the disclosure, an article of footwear can include an upper and a sole structure coupled to the upper. The sole structure can define a ground engaging surface, and can include a cushioning member coupled to the upper and an outsole coupled to the cushioning member. The outsole can include a front outsole segment positioned in a forefoot region and a rear outsole segment positioned in a heel region. The rear segment can be discontinuous with the front outsole segment along the ground engaging surface. The front outsole segment can include a medial segment with a first plurality of lobes arranged along a medial side of the sole structure and a lateral segment with a second plurality of lobes arranged along a lateral side of the sole structure.

In some embodiments, each lobe of the first plurality of lobes and the second plurality of lobes can be independently moveable relative to one another to displace a force to the cushioning member. In some cases, the front outsole segment can be discontinuous along the ground engaging surface between the lateral side and the medial side such that the front outsole segment can define an open area between the lateral segment and the medial segment. The cushioning member can extend across the open area.

In some embodiments, the front outsole segment can include a plurality of first ground engaging elements and a plurality of second ground engaging elements. The plurality of second ground engaging elements can be shaped differently from the first ground engaging elements. Each of the first plurality of lobes and the second plurality of lobes can include a first ground engaging element of the plurality of first ground engaging elements. In some cases, the rear outsole segment can include a plurality of third ground engaging elements.

In some embodiments, the outsole can include a first portion in a forefoot region of the sole structure and a second portion in a midfoot region of the sole structure. The first portion can extend across the forefoot region from a lateral side of the sole structure to a medial side of the sole structure. The second portion can extend partially across the sole structure from the lateral side to the medial side. In some cases, the outsole can include a plurality of ribs extending in a direction between a heel region and the forefoot region.

According to yet another aspect of the disclosure, a sole structure can be provided for an article of footwear having an upper. The sole structure can include cushioning member extending through each of a forefoot region, a midfoot region, and a heel region. A plate can be coupled to the cushioning member. The plate can include a front portion disposed in the forefoot region and a rear portion disposed in the heel region. The front portion can include a first segment and a second segment extending outward from a periphery of the front portion. The second segment can be formed as a plurality of lobes.

In some embodiments, the plate can extend continuously through each of the forefoot region, the midfoot region, and the heel region. The second segment can be disposed within the forefoot region. Each of the plurality of lobes of the second segment can be provided with one of a plurality first ground engaging members. The first segment may not include the plurality first ground engaging members.

In some embodiments, the second segment can be disposed in the forefoot region and can include a medial segment forming a plurality of medial lobes extending outwardly from the first segment toward a medial side of the sole structure, and a lateral segment forming a plurality of lateral lobes extending outwardly from the first segment toward a lateral side of the sole structure. The plate can define an open area between the medial segment and the lateral segment. The cushioning member can extend through the open area. In some cases, a first lobe of the plurality of medial lobes and a second lobe of the plurality of lateral lobes can be arranged in an opposed configuration about the open area.

According to still another aspect of the disclosure, an article of footwear can include an upper and a sole structure coupled to the upper. The sole structure can define a ground engaging surface, and can include a cushioning member and an outsole. The cushioning member can be coupled to the upper and can extend through each of a forefoot region, a midfoot region, and a heel region. The outsole can include a front portion that can be disposed in the forefoot region and a rear portion that can be disposed in the heel region. The front portion can be discontinuous with the front portion along the ground engaging surface. The front portion is configured as a rigid plate and can include a central segment, a medial segment, and a lateral segment. The medial segment can include a first plurality of lobes extending from a medial periphery of the central segment toward a medial side of the sole structure. Each of the first plurality of lobes can include a medial ground engaging member. The lateral segment can include a second plurality of lobes extending from a lateral periphery of the central segment toward a lateral side of the sole structure. Each of the second plurality of lobes can include a lateral ground engaging member. An open area can be defined between the lateral segment and the medial segment. At least one of the first plurality of lobes can be arranged in an opposed configuration with a corresponding one of the second of plurality lobes about the open area. The cushioning member can extend through the open area to define a portion of the ground engaging surface.

Other aspects of the article of footwear, including features and advantages thereof, will become apparent to one of ordinary skill in the art upon examination of the figures and detailed description herein. Therefore, all such aspects of the article of footwear are intended to be included in the detailed description and this summary.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **2** is a bottom view of the article of footwear of FIG. **1**;

FIG. **3** is a rear view of the article of footwear of FIG. **1**;

FIG. **4** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **5** is a bottom view of the article of footwear of FIG. **4**;

FIG. **6** is a rear view of the article of footwear of FIG. **4**;

FIG. **7** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **8** is a bottom view of the article of footwear of FIG. **7**;

FIG. **9** is a rear view of the article of footwear of FIG. **7**;

FIG. **10** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **11** is a bottom view of the article of footwear of FIG. **10**;

FIG. **12** is a rear view of the article of footwear of FIG. **10**;

FIG. **13** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **14** is a bottom view of the article of footwear of FIG. **13**;

FIG. **15** is a rear view of the article of footwear of FIG. **13**;

FIG. **16** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **17** is a bottom view of the article of footwear of FIG. **16**;

FIG. **18** is a rear view of the article of footwear of FIG. **16**;

FIG. **19** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **20** is a bottom view of the article of footwear of FIG. **19**;

FIG. **21** is a rear view of the article of footwear of FIG. **19**;

FIG. **22** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **23** is a bottom view of the article of footwear of FIG. **22**;

FIG. **24** is a rear view of the article of footwear of FIG. **22**;

FIG. **25** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **26** is a bottom view of the article of footwear of FIG. **25**;

FIG. **27** is a rear view of the article of footwear of FIG. **25**;

FIG. **28** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **29** is a bottom view of the article of footwear of FIG. **28**;

FIG. **30** is a rear view of the article of footwear of FIG. **28**;

FIG. **31** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **32** is a bottom view of the article of footwear of FIG. **31**;

FIG. **33** is a rear view of the article of footwear of FIG. **31**;

FIG. **34** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **35** is a bottom view of the article of footwear of FIG. **34**;

FIG. **36** is a rear view of the article of footwear of FIG. **34**;

FIG. **37** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **38** is a bottom view of the article of footwear of FIG. **37**;

FIG. **39** is a rear view of the article of footwear of FIG. **37**;

FIG. **40** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **41** is a bottom view of the article of footwear of FIG. **40**;

FIG. **42** is a rear view of the article of footwear of FIG. **40**;

FIG. **43** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **44** is a bottom view of the article of footwear of FIG. **43**;

FIG. **45** is a rear view of the article of footwear of FIG. **43**;

FIG. **46** is a lateral side view of an article of footwear configured as a left shoe that includes an upper and a sole structure, according to an embodiment of the disclosure;

FIG. **47** is a bottom view of the article of footwear of FIG. **46**;

FIG. **48** is a rear view of the article of footwear of FIG. **46**;

FIG. **49** is a medial side view of a sole structure for an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **50** is a bottom view of the sole structure of FIG. **49**;

FIG. **51** is a lateral side view of the sole structure of FIG. **49**;

FIG. **52** is a front view of the sole structure of FIG. **49**;

FIG. **53** is a rear view of the sole structure of FIG. **49**;

FIG. **54** is a cross-sectional view of the sole structure of FIG. **49** on an article of footwear taken along line **54-54** of FIG. **50**;

FIG. **55** is a cross-sectional view of the sole structure of FIG. **49** on an article of footwear taken along line **55-55** of FIG. **50**;

FIG. **56** is a cross-sectional view of the sole structure of FIG. **49** on an article of footwear taken along line **56-56** of FIG. **50**;

FIG. **57** is a cross-sectional view of the sole structure of FIG. **49** on an article of footwear taken along line **57-57** of FIG. **50**;

FIG. **58** is a cross-sectional view of the sole structure of FIG. **49** on an article of footwear taken along line **58-58** of FIG. **50**;

FIG. **59** is a cross-sectional view of the sole structure of FIG. **49** on an article of footwear taken along line **59-59** of FIG. **50**;

FIG. **60** is a medial side view of a sole structure for an article of footwear configured as a left shoe that includes an upper and a sole structure, according to another embodiment of the disclosure;

FIG. **61** is a bottom view of the sole structure of FIG. **60**;

FIG. **62** is a lateral side view of the sole structure of FIG. **60** on an article of footwear;

FIG. **63** is a medial side view of a sole structure for an article of footwear configured as a left shoe, according to another embodiment of the disclosure;

FIG. **64** is a bottom view of the sole structure of FIG. **63**;

FIG. **65** is a lateral side view of the sole structure of FIG. **63**;

FIG. **66** is a cross-sectional view of the sole structure of FIG. **63** on an article of footwear taken along line **66-66** of FIG. **64**; and

FIG. **67** is an isometric view of an outsole of the sole structure of FIG. **63** of an article of footwear.

DETAILED DESCRIPTION OF THE DRAWINGS

The following discussion and accompanying figures disclose various embodiments or configurations of a shoe and a sole structure. Although embodiments of a shoe or sole structure are disclosed with reference to a sports shoe, such as a running shoe, tennis shoe, basketball shoe, etc., concepts associated with embodiments of the shoe or the sole structure may be applied to a wide range of footwear and footwear styles, including cross-training shoes, football shoes, golf shoes, hiking shoes, hiking boots, ski and snowboard boots, soccer shoes and cleats, walking shoes, and track cleats, for example. Concepts of the shoe or the sole structure may also be applied to articles of footwear that are considered non-athletic, including dress shoes, sandals, loafers, slippers, and heels. In addition to footwear, particular concepts described herein may also be applied and incorporated in other types of apparel or other athletic equipment, including helmets, padding or protective pads, shin guards, and gloves. Even further, particular concepts described herein may be incorporated in cushions, backpack straps, golf clubs, or other consumer or industrial products. Accordingly, concepts described herein may be utilized in a variety of products.

The term "about," as used herein, refers to variation in the numerical quantity that may occur, for example, through typical measuring and manufacturing procedures used for articles of footwear or other articles of manufacture that may include embodiments of the disclosure herein; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or mixtures or carry out the methods; and the like. Throughout the disclosure, the terms "about" and "approximately" refer to a range of values±5% of the numeric value that the term precedes.

The terms "weight percent," "wt-%," "percent by weight," "% by weight," and variations thereof, as used herein, refer to the concentration of a substance or component as the weight of that substance or component divided by the total weight, for example, of the composition or of a particular component of the composition, and multiplied by 100. It is understood that, as used herein, "percent," "%," and the like may be synonymous with "weight percent" and "wt-%."

As used herein in the context of geometric descriptions, unless otherwise limited or defined, "substantially" indicates correspondence to a particular shape or dimension within conventional manufacturing tolerances for components of a similar type or that are formed using similar processes. In this regard, for example, "substantially round" can indicate a profile that deviates from a circle to within acceptable manufacturing tolerances.

Further, as used herein, unless otherwise defined or limited, directional terms are used for convenience of reference for discussion of particular figures or examples. For example, references to "downward," or other directions, or "lower" or other positions, may be used to discuss aspects of a particular example or figure, but do not necessarily require similar orientation or geometry in all installations or configurations.

The present disclosure is directed to an article of footwear and/or specific components of the article of footwear, such as an upper and/or a sole or sole structure. The upper may comprise a knitted component, a woven textile, and/or a non-woven textile. The knitted component may be made by knitting of yarn, the woven textile by weaving of yarn, and the non-woven textile by manufacture of a unitary non-woven web. Knitted textiles include textiles formed by way of warp knitting, weft knitting, flat knitting, circular knitting, and/or other suitable knitting operations. The knit textile may have a plain knit structure, a mesh knit structure, and/or a rib knit structure, for example. Woven textiles include, but are not limited to, textiles formed by way of any of the numerous weave forms, such as plain weave, twill weave, satin weave, dobbin weave, jacquard weave, double weaves, and/or double cloth weaves, for example. Non-woven textiles include textiles made by air-laid and/or spun-laid methods, for example. The upper may comprise a variety of materials, such as a first yarn, a second yarn, and/or a third yarn, which may have varying properties or varying visual characteristics.

FIGS. **1-3** depict an embodiment of an article of footwear **100** including an upper **102** a top portion **120**, and a sole structure **104**. The upper **102** is attached to the top portion **120** and together define an interior cavity into which a foot may be inserted. For reference, the article of footwear **100** defines a forefoot region **108**, a midfoot region **110**, and a heel region **112**. The forefoot region **108** generally corresponds with portions of the article of footwear **100** that encase portions of the foot that includes the toes, the ball of the foot, and joints connecting the metatarsals with the toes or phalanges. The midfoot region **110** is proximate and adjoining the forefoot region **108**, and generally corresponds with portions of the article of footwear **100** that encase the arch of the foot, along with the bridge of the foot. The heel region **112** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

Many conventional footwear uppers are formed from multiple elements (e.g., textiles, polymer foam, polymer sheets, leather, and synthetic leather) that are joined through bonding or stitching at a seam. In some embodiments, the upper **102** of the article of footwear **100** is formed from a knitted structure or knitted components. In various embodiments, a knitted component may incorporate various types of yarn that may provide different properties to an upper. For example, one area of the upper **102** may be formed from a first type of yarn that imparts a first set of properties, and another area of the upper **102** may be formed from a second type of yarn that imparts a second set of properties. Using this configuration, properties of the upper **102** may vary throughout the upper **102** by selecting specific yarns for different areas of the upper **102**.

The article of footwear **100** also includes a medial side **116** (e.g., see FIG. **2**) and a lateral side **118** (e.g., see FIG. **2**). In particular, the lateral side **118** corresponds to an outside portion of the article of footwear **100** and the medial

side **116** corresponds to an inside portion of the article of footwear **100**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **116** are closest to one another when a user is wearing the articles of footwear **100**, while the lateral sides **118** are defined as the sides that are farthest from one another while being worn. The medial side **116** and the lateral side **118** adjoin one another at opposing, distal ends of the article of footwear **100**.

Unless otherwise specified, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** are intended to define boundaries or areas of the article of footwear **100**. To that end, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** generally characterize sections of the article of footwear **100**. Further, the upper **102**, the top portion **120**, and the sole structure **104** may be characterized as having portions within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**. Therefore, the upper **102**, the top portion **120**, and the sole structure **104**, and/or individual portions of the upper **102**, the top portion **120**, and the sole structure **104**, may include portions thereof that are disposed within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**.

The top portion **120** is connected to the upper **102** and, as stated above, can provide support for an arch of a user. The top portion **120** can be a strobel board, a forefoot board, a lasting board, etc., or a combination thereof and may include an insole. In some embodiments, the top portion **120** can provide support for an arch of a user.

The sole structure **104** is connected or secured to the top portion **120** and extends between a foot of a user and the ground when the article of footwear **100** is worn by the user. The sole structure **104** may include one or more components, which may include an outsole, a midsole, and/or a heel. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, and a midsole that provides a cushioning system. As will be further discussed herein, the sole structure **104** of the present embodiment of the invention includes one or more components that provide the sole structure **104** with preferable spring and damping properties.

The sole structure **104** includes an outsole **130**. The outsole **130** may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **104**. In some embodiments, the outsole **130** may comprise a polyurethane (PU) plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the outsole **130** can include carbon fiber or high-density wood, for example. In some embodiments, the outsole **130** has a uniform thickness.

As shown in FIGS. **1** and **2**, the outsole **130** has a front portion **132**, a middle portion **134**, and a rear portion **136**. The outsole **130** extends front to rear through the forefoot region **108** and the midfoot region **110** and at least partially through the heel region **112**. Further, the outsole **130** can extend across the entire forefoot region **108** from the medial side **116** to the lateral side **118** and only partially across the midfoot and heel regions **110**, **112**. The front portion **132** of the outsole **130** is coupled to the upper **102** and the top portion **120** at the forefoot region **108** at a forefoot coupling point **176** and the middle portion **134** is coupled to the top portion **120** at the midfoot region **110** at a midfoot coupling point **178**. The outsole **130** is spaced from the top portion **120** between the forefoot coupling point **176** and the midfoot coupling point **178**, and defines a front spacing **140** at the forefoot region **108**.

The article of footwear **100** is shown in a rested, or unloaded state (i.e., no downward force is being exerted on the article of footwear **100** other than the nominal force of gravity). When viewed from the side and from beneath, the front spacing **140** has a first longitudinal length **122** defined as a straight line distance between the forefoot coupling point **176** and the midfoot coupling point **178**. In the embodiment shown, the front spacing **140** has a crescent profile with a curved length **124** defined as a curved line following the midpoint between the top portion **120** and the outsole **130** along the first longitudinal length **122** and between the forefoot coupling point **176** and the midfoot coupling point **178**. The front spacing **140** also has a first gap height **126** defined by the distance between the top portion **120** and the outsole **130**. The first gap height **126** changes along the curved length **124**, increasing and then decreasing from the forefoot region **108** to the midfoot region **110**, with the first gap height **126** being largest beneath where the ball of a user's foot would be received within the upper **102** and being defined as the maximum first gap height **126**A. The front spacing **140** also has a front spacing volume **128** as defined by the top portion **120**, the outsole **130**, and an unseen boundary extending from and between the periphery of the top portion **120** and the outsole **130**.

As further illustrated in FIGS. **1** and **3**, the middle portion **134** of the outsole **130** extends away from the midfoot coupling point **178**, spacing the rear portion **136** of the outsole **130** at the heel region **112** from the top portion **120** and defining a rear spacing **142** between the rear portion **136** and the top portion **120**. When viewed from the side, the rear spacing **142** has a wedge profile. As shown, the rear spacing **142** has a second longitudinal length **170** defined as a straight line distance between the midfoot coupling point **178** and a terminal end **160** of the rear portion **136** of the outsole **130**. The rear spacing **142** also has a second gap height **172** defined by the distance between the top portion **120** and the outsole **130** along the second longitudinal length **170**. The second gap height **172** increases from the midfoot region **110** toward the heel region **112** and is substantially constant along the heel region **112** beneath where the heel of a user's foot would be received within the upper **102**. The greatest height of the second gap height **172** defining a maximum second gap height **172**A. The rear spacing **142** also has a rear spacing volume **174** as defined by the top portion **120**, the outsole **130**, and an unseen boundary extending from and between the periphery of the top portion **120** and the outsole **130** in the heel region **112**.

In the rested state, the first longitudinal length **122** of the article of footwear **100** is greater than the second longitudinal length **170** and the maximum first gap height **126**A is smaller than the maximum second gap height **172**A. In some embodiments, the first longitudinal length **122** can be in a range from about 1.5 times to about 2.0 times the second longitudinal length **170**. In some embodiments, the maximum second gap height **172**A can be in a range from about 1.1 times to about 1.5 times the maximum first gap height **126**A. In some embodiments, the front spacing volume is approximately the same as the rear spacing volume.

In a neutral state (not shown), when a user's foot is received within the upper **102** and the user is standing (i.e., no downward force is being applied to the article of footwear **100** other than the weight of the user), the first gap height

126 is decreased due to the top portion **120** being urged toward the outsole **130** under the force of the weight of the user. In some embodiments, for example, the percentage decrease in the front spacing volume **128** from the rested state to the neutral state can be in a range of about 1 percent to about 20 percent, more preferably the percentage decrease in the front spacing volume **128** can be in a range of about 5 percent to about 10 percent. Additionally, the rear spacing volume **174** will be decreased in the neutral state. In some embodiments, for example, the percentage decrease of the rear spacing volume **174** from the rested state to the neutral state can be in a range of about 1 percent to about 50 percent, more preferably the percentage decrease in the rear spacing volume **174** can be in a range of about 10 percent to about 30 percent. Further, the middle portion **134** of the outsole **130** contacts the top portion **120** in the midfoot region **110** and provides additional support of the arch of the user when in the neutral state.

During use, in an active state (not shown), when the outsole **130** is in contact with the ground and a user exerts a downward force in the forefoot region **108**, the downward force will urge the top portion **120** toward the outsole **130** and further decrease the front spacing volume **128** while lengthening the first longitudinal length **122**. In some embodiments, for example, the percentage decrease in the first spacing volume **128** from the rested state to the active state can be a range of about 10 percent to about 100 percent, more preferably, the percentage decrease in the front spacing volume **128** can be in a range of about 50 percent to about 90 percent. Additionally, in the active state, if a user applies a force to the heel portion **112**, the rear spacing volume **174** can experience a percentage decrease in volume. In some embodiments, for example, the decrease in volume from the rested state to the active state can be in a range of about 90 percent to about 100 percent. Further, the middle portion **134** of the outsole **130** can act as a fulcrum when in the active state. For example, a user can strike the heel portion **112** on the ground while walking or running and rotate the foot forward about the middle portion **134** in the midfoot region **110**, and continue rotating the foot forward, striking the forefoot region **108** on the ground.

The outsole **130** along with the front spacing **140** and the rear spacing **142** can therefore provide force absorption as a user exerts downward force onto the forefoot region **108** and the heel region **112**, respectively, of the article of footwear **100** and can also provide a spring effect as the downward force from the user is relieved. This can reduce the severity of the impact to a user's foot and leg joints during use.

The outsole **130** may define a bottom end or bottom surface **138** of the sole structure **104** across the forefoot region **108**, the midfoot region **110**, and the heel region **112**. Further, the outsole **130** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **104** and may be opposite of the upper **102**. For example, the outsole **130** can include any combination of ground engaging members (e.g., spikes **144**, teeth **146**, and barbs **148**) that extend from the bottom surface **138** of the outsole **130** and which can be positioned throughout the front portion **132** and the rear portion **136**.

As shown, the article of footwear **100** includes spikes **144** and teeth **146** in the front portion **132** and barbs **148** in the front and rear portions **132**, **136**. The number and placement of spikes can affect traction with respect to linear movement. In some embodiments, the spikes **144** can vary in shape and size depending on user preference and environmental considerations such as the type of ground surface covering and weather conditions. For example, see the small spikes **1794** in FIGS. **49-53** and as discussed with respect to another embodiment or an article of footwear **1700** below. It is contemplated that at least one of the spikes **144** can be removable.

The teeth **146** can extend from and can be spaced around the periphery of the outsole **130** in the front portion **132**. As shown, the teeth **146** can be blade-like and can have a rectangular profile. The number and placement of teeth **146** can affect traction with respect to lateral and medial (i.e., side-to-side) movement. In some embodiments, the teeth **146** can be formed as part of the outsole **130** during the production of the outsole **130** (e.g., the teeth **146** can be formed as continuous extensions of the outsole **130**). Further, the teeth **146** can be provided in groups, for example in groups of two or three as shown. Teeth **146** can also be provided in front of a user's toe to support "toe off."

The barbs **148** can extend from the outsole **130** at multiple locations and can be angled toward the rear of the article of footwear **100**. In some embodiments, the barbs **148** can be formed as part of the outsole **130** (e.g., the barbs **148** can be formed as continuous extensions of the outsole **130**).

FIGS. **4-6** show another embodiment of an article of footwear **200**. In many aspects, the article of footwear **200** is similar to the article of footwear **100** described above and similar numbering in the **200** series is used for the article of footwear **200**. For example, the article of footwear **200** includes an upper **202**, a top portion **220**, and a sole structure **204** with an outsole **230**. The upper **202** defines a forefoot region **208**, a midfoot region **210**, and a heel region **212**. Further, the article of footwear **200** also includes a medial side **216** corresponding to an inside portion of the article of footwear **200** and a lateral side **218** corresponding to an outside portion of the article of footwear **200**.

Additionally, the outsole **230** may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **204**. The outsole **230** has a front portion **232**, a middle portion **234**, and a rear portion **236** with a terminal end **260**. The outsole **230** extends front to rear through the forefoot region **208** and the midfoot region **210** and at least partially through the heel region **212**. Further, the outsole **230** can extend across the entire forefoot region **208** from the medial side **216** to the lateral side **218** and only partially across the midfoot and heel regions **210**, **212**. The front portion **232** of the outsole **230** is coupled to the top portion **220** at the forefoot region **208** at a forefoot coupling point **276** and the middle portion **234** is coupled to the top portion **220** at the midfoot region **210** at a midfoot coupling point **278**. The outsole **230** is spaced from the top portion **220** between the forefoot coupling point **276** and the midfoot coupling point **278**, and defines a front spacing **240**, a first longitudinal length **222**, a curved length **224**, a first gap height **226** with a maximum first gap height **226**A, and a front spacing volume **228**. As further illustrated in FIGS. **4** and **6**, the middle portion **234** of the outsole **230** extends away from the midfoot coupling point **278**, spacing the rear portion **236** of the outsole **230** from the top portion **220** and defining a rear spacing **242**, a second longitudinal length **270**, a second gap height **272** with a maximum second gap height **272**A, and a rear spacing volume **274**. The outsole **230** also has at least one ground engaging member (e.g., a spike **244**, a tooth **246**, or a barb **248**) extending from a bottom surface **238** thereof.

In some aspects, however, the articles of footwear **100**, **200** differ from each other. For example, the sole structure **204** includes a front cushioning member **250**. The front cushioning member **250** may be positioned within the front spacing **240** between the outsole **230** and the upper **202** and

can extend across the front portion **232** from the medial side **216** to the lateral side **218**. In some embodiments, for example, the volume of the front cushioning member **250** can be in a range of about 85 percent to about 95 percent of the front spacing volume **228**.

The front cushioning member **250** can be individually constructed from a thermoplastic material, such as PU, for example, and/or an ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, the front cushioning member **250** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The front cushioning member **250** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer. One example of a PEBA material is PEBAX®.

In embodiments where the front cushioning member **250** is formed from a supercritical foaming process, the supercritical foam may comprise micropore foams or particle foams, such as a TPU, EVA, PEBAX®, or mixtures thereof, manufactured using a process that is performed within an autoclave, an injection molding apparatus, or any sufficiently heated/pressurized container that can process the mixing of a supercritical fluid (e.g., CO_2, N_2, or mixtures thereof) with a material (e.g., TPU, EVA, polyolefin elastomer, or mixtures thereof) that is preferably molten. In one example process, a solution of supercritical fluid and molten material can be pumped into a pressurized container, after which the pressure within the container is released, such that the molecules of the supercritical fluid rapidly convert to gas to form small pockets within the material and cause the material to expand into a foam, which may be used as the front cushioning member **250**. In further embodiments, the front cushioning member **250** may be formed using alternative methods known in the art, including the use of an expansion press, an injection machine, a pellet expansion process, a cold foaming process, a compression molding technique, die cutting, or any combination thereof. For example, the front cushioning member **250** may be formed using a process that involves an initial foaming step in which supercritical gas is used to foam a material and then compression molded or die cut to a particular shape. Additionally, or alternatively, an air-bladder/bag made out of blown polymer (e.g., TPU) and pressurized with air can be used as a front cushioning member.

The sole structure **204** as described with the front cushioning member **250** provided within the front spacing **240** of the outsole **230** can provide spring and dampening properties. This can reduce the severity of the impact to a user's foot and leg joints during use.

FIGS. **7-9** show another embodiment of an article of footwear **300**. In many aspects, the article of footwear **300** is similar to the article of footwear **200** described above and similar numbering in the **300** series is used for the article of footwear **300**. For example, the article of footwear **300** includes an upper **302**, a top portion **320**, and a sole structure **304** with an outsole **330**. The upper **302** defines a forefoot region **308**, a midfoot region **310**, and a heel region **312**. Further, the article of footwear **300** also includes a medial side **316** corresponding to an inside portion of the article of footwear **300** and a lateral side **318** corresponding to an outside portion of the article of footwear **300**.

Additionally, the outsole **330** may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **304**. The outsole **330** has a front portion **332**, a middle portion **334**, and a rear portion **336** with a terminal end **360**. The outsole **330** extends front to rear through the forefoot region **308** and the midfoot region **310** and at least partially through the heel region **312**. Further, the outsole **330** can extend across the entire forefoot region **308** from the medial side **316** to the lateral side **318** and only partially across the midfoot and heel regions **310**, **312**. The front portion **332** of the outsole **330** is coupled to the top portion **320** at the forefoot region **308** at a forefoot coupling point **376** and the middle portion **334** is coupled to the top portion **320** at the midfoot region **310** at a midfoot coupling point **378**. The outsole **330** is spaced from the top portion **320** between the forefoot coupling point **376** and the midfoot coupling point **378**, defining a front spacing **340** at the forefoot region **308**, a first longitudinal length **322**, a curved length **324**, a first gap height **326** with a maximum first gap height **326**A, and a front spacing volume **328**. As further illustrated in FIGS. **7** and **9**, the middle portion **334** of the outsole **330** extends away from the midfoot coupling point **378**, spacing the rear portion **336** of the outsole **330** from the top portion **320** and defining a rear spacing **342**, a second longitudinal length **370**, a second gap height **372** with a maximum second gap height **372**A, and a rear spacing volume **374**. The outsole **330** also has at least one ground engaging member (e.g., a spike **344**, a tooth **346**, or a barb **348**) extending from a bottom surface **338** thereof.

Further, the sole structure **304** includes a front cushioning member **350**. The front cushioning member **350** is positioned within the front spacing **340** between the outsole **330** and the upper **302** and extends across the forefoot region **308** from the medial side **316** to the lateral side **318** similar to that of the front cushioning member **250** in the article of footwear **200**. The front cushioning member **350** can be formed from any of the materials and processes described above with respect to the front cushioning member **250** of the article of footwear **200**.

In some aspects, however, the articles of footwear **200**, **300** differ from each other. For example, the sole structure **304** also includes a rear cushioning member **352**. The rear cushioning member **352** may be positioned within the rear spacing **342** between the outsole **330** and the upper **302**. The rear cushioning member **352** extends across a portion of the rear portion **336** of the outsole **330**. In some embodiments, for example, the volume of the rear cushioning member **352** can be in a range of about 35 percent to about 50 percent of the rear spacing volume **374**. In some embodiments, the rear cushioning member **352** can define a rear spacing pocket **354** adjacent the front side of the rear cushioning member **352**. The rear spacing pocket **354** extends longitudinally between the midfoot coupling point **378** and the rear cushioning member **352**, latitudinally between the medial side **316** and the lateral side **318**, and vertically between the top portion **320** and the outsole **330**. As shown in FIGS. **7** and **9**, the rear cushioning member **352** is positioned directly beneath where the heel of a user's foot would be received within the upper **302**. For example, the rear cushioning member **352** is positioned within the rear spacing pocket **354** at the location of and adjacent the maximum second gap height **372**A. The rear cushioning member **352** can be formed from any of the materials and processes described above with respect to the front cushioning member **250** of the article of footwear **200**.

The sole structure **304** as described with the front cushioning member **350** provided within the front spacing **340** of the outsole **330** and the rear cushioning member **352** provided within the rear spacing **342** of the outsole **330** can provide spring and dampening properties, which can reduce the severity of the impact to a user's foot and leg joints during use.

FIGS. **10-24** show other embodiments of an article of footwear **400**, **500**, **600**, **700**, **800**. In many aspects, the articles of footwear **400**, **500**, **600**, **700**, **800** are similar to the articles of footwear **100**, **200**, **300** described above and similar numbering in the **400**, **500**, **600**, **700**, **800** series is used for the articles of footwear **400**, **500**, **600**, **700**, **800**. For example, each of the articles of footwear **400**, **500**, **600**, **700**, **800** include an upper **402**, **502**, **602**, **702**, **802**; a top portion **420**, **520**, **620**, **720**, **820**; and a sole structure **404**, **504**, **604**, **704**, **804** with an outsole **430**, **530**, **630**, **730**, **830**. Each outsole **430**, **530**, **630**, **730**, **830** may be a rigid plate and has a front portion **432**, **532**, **632**, **732**, **832**; a middle portion **434**, **534**, **634**, **734**, **834**; and a rear portion **436**, **536**, **636**, **736**, **836** with a terminal end **460**, **560**, **660**, **760**, **860**. Additionally, each article of footwear **400**, **500**, **600**, **700**, **800** defines a forefoot region **408**, **508**, **608**, **708**, **808**; a midfoot region **410**, **510**, **610**, **710**, **810**; and a heel region **412**, **512**, **612**, **712**, **812** and has a medial side **416**, **516**, **616**, **716**, **816** and a lateral side **418**, **518**, **618**, **718**, **818**. The outsole **430**, **530**, **630**, **730**, **830** can also be coupled to the top portion **420**, **520**, **620**, **720**, **820** at a forefoot coupling point **476**, **576**, **676**, **767**, **876** and at a midfoot coupling point **478**, **578**, **678**, **778**, **878**.

Further, each article of footwear **400**, **500**, **600**, **700**, **800** defines a front spacing **440**, **540**, **640**, **740**, **840** with a first longitudinal length **422**, **522**, **622**, **722**, **822**; a curved length **424**, **524**, **624**, **724**, **824**; a first gap height **426**, **526**, **626**, **726**, **826** with a maximum first gap height **426**A, **526**A, **626**A, **726**A, **826**A; and a front spacing volume **428**, **528**, **628**, **728**, **828** and a rear spacing **442**, **542**, **642**, **742**, **842** with a second longitudinal length **470**, **570**, **670**, **770**, **870**; a second gap height **472**, **572**, **672**, **772**, **872** with a maximum second gap height **472**A, **572**A, **672**A, **772**A, **872**A; and a rear spacing volume **474**, **574**, **674**, **774**, **874** and has at least one ground engaging member (e.g., a spike **444**, **544**, **644**, **744**, **844**; a tooth **446**, **546**, **646**, **746**, **846**; or a barb **448**, **548**, **648**, **748**, **848**) extending from a bottom surface **438**, **538**, **638**, **738**, **838** of the outsole **430**, **530**, **630**, **730**, **830**. However, each embodiment differs regarding the inclusion and arrangement of the front and rear cushioning members. When included, however, the materials comprising and processes for making the front and rear cushioning members are as described above.

FIGS. **10-12** illustrate the article of footwear **400** in which both a front cushioning member **450** and a rear cushioning member **452** are provided (hidden in FIG. **11**). The front cushioning member **450** is positioned within the front spacing **440** between the outsole **430** and the upper **402** and extends across the front portion **432** of the outsole **430** from the medial side **416** to the lateral side **418**. In some embodiments, for example, the volume of the front cushioning member **450** can be in a range of about 85 percent to about 95 percent of the front spacing volume **428**. Further, the rear cushioning member **452** is positioned within the rear spacing **442** between the outsole **430** and the upper **402** and extends across the rear portion **436** of the outsole **430** from the medial side **416** to the lateral side **418**. In some embodiments, for example, the volume of the rear cushioning member **452** can be in a range of about 70 percent to about 95 percent of the rear spacing volume **474**.

In FIGS. **13-15**, the article of footwear **500** is shown with both a front cushioning member **550** and a rear cushioning member **552** (hidden in FIG. **14**). The front cushioning member **550** is positioned within the front spacing **540** between the outsole **530** and the upper **502** and extends across a portion of the front portion **532** of the outsole **530**. In some embodiments, for example, the volume of the front cushioning member **550** can be in a range of about 35 percent to about 50 percent of the front spacing volume **528**. In some embodiments, the front cushioning member **550** defines a first front spacing pocket **556** and a second front spacing pocket **558** adjacent the front and rear sides of the front cushioning member **550**, respectively. The first front spacing pocket **556** extends longitudinally between the forefoot coupling point **576** and the front cushioning member **550**, latitudinally between the medial side **516** and the lateral side **518**, and vertically between the top portion **520** and the outsole **530**. The second front spacing pocket **558** extends longitudinally between the front cushioning member **550** and the midfoot coupling point **578**, latitudinally from the medial side **516** to the lateral side **518**. and vertically between the top portion **520** and the outsole **530**. As shown, the front cushioning member **550** can be positioned directly beneath where the ball of a user's foot would be received within the upper **502**. For example, the front cushioning member **550** is positioned within the front spacing pocket **556** at the location of and adjacent the maximum first gap height **526**A. Further, the rear cushioning member **552** is positioned within the rear spacing **542** between the outsole **530** and the upper **502** and extends across the rear portion **536** of the outsole **530** from the medial side **516** to the lateral side **518**. In some embodiments, for example, the volume of the rear cushioning member **552** can be in a range of about 70 percent to about 95 percent of the rear spacing volume **574**.

FIGS. **16-18** show the article of footwear **600** with both a front cushioning member **650** and a rear cushioning member **652** (hidden in FIG. **17**). The front cushioning member **650** is positioned within the front spacing **640** between the outsole **630** and the upper **602** and extends across a portion of the front portion **632** of the outsole **630**. In some embodiments, for example, the volume of the front cushioning member **650** can be in a range of about 35 percent to about 50 percent of the front spacing volume **628**. In some embodiments, the front cushioning member **650** defines a first front spacing pocket **656** and a second front spacing pocket **658** adjacent the front and rear sides of the front cushioning member **650**, respectively. The first front spacing pocket **656** extends longitudinally between the forefoot coupling point **676** and the front cushioning member **650**, latitudinally between the medial side **616** and the lateral side **618**, and vertically between the top portion **620** and the outsole **630**. The second front spacing pocket **658** extends longitudinally between the front cushioning member **650** and the midfoot coupling point **678**, latitudinally between the medial side **616** and the lateral side **618**, and vertically between the top portion **620** and the outsole **630**. As shown, the front cushioning member **650** can be positioned directly beneath where the ball of a user's foot would be received within the upper **602**. For example, the front cushioning member **650** is positioned within the front spacing pocket **656** at the location of and adjacent the maximum first gap height **626**A. The rear cushioning member **652** is positioned within the rear spacing **642** between the outsole **630** and the upper **602**. The rear cushioning member **652** extends across a portion of the rear portion **636** of the outsole **630**. In some embodiments, for example, the volume

of the rear cushioning member **652** can be in a range of about 35 percent to about 50 percent of the rear spacing volume **674**. In some embodiments, the rear cushioning member **652** can define a rear spacing pocket **654** adjacent the front side of the rear cushioning member **652**. The rear spacing pocket **654** extends longitudinally between the midfoot coupling point **678** and the rear cushioning member **652**, latitudinally between the medial side **616** and the lateral side **618**, and vertically between the top portion **620** and the outsole **630**. As shown, the rear cushioning member **652** is positioned directly beneath where the heel of a user's foot would be received within the upper **602**. For example, the rear cushioning member **652** is positioned within the rear spacing pocket **654** at the location of and adjacent the maximum second gap height **672**A.

The article of footwear **700** is shown in FIGS. **19-21**. The article of footwear **700** does not have a front cushioning member within the front spacing **740** but does have a rear cushioning member **752** within the rear spacing **742** (hidden in FIG. **20**). The rear cushioning member **752** is positioned within the rear spacing **742** between the outsole **730** and the upper **702**. The rear cushioning member **752** extends across a portion of the rear portion **736** of the outsole **730**. In some embodiments, for example, the volume of the rear cushioning member **752** can be in a range of about 35 percent to about 50 percent of the rear spacing volume **774**. In some embodiments, the rear cushioning member can define a rear spacing pocket **754** adjacent the front side of the rear cushioning member **752**. The rear spacing pocket **754** extends longitudinally between the midfoot coupling point **778** and the rear cushioning member **752**, latitudinally between the medial side **716** and the lateral side **718**, and vertically between the top portion **720** and the outsole **730**. As shown, the rear cushioning member **752** is positioned directly beneath where the heel of a user's foot would be received within the upper **702**. For example, the rear cushioning member **752** is positioned within the rear spacing pocket **754** at the location of and adjacent the maximum second gap height **772**A.

FIGS. **22-24** illustrate the article of footwear **800**. The article of footwear **800** does not have a front cushioning member within the front spacing **840** but does have a rear cushioning member **852** within the rear spacing **842** (hidden in FIG. **23**). The rear cushioning member **852** is positioned within the rear spacing **842** between the outsole **830** and the upper **802** and extends across the rear portion **836** of the outsole **830** from the medial side **816** to the lateral side **818**. In some embodiments, for example, the volume of the rear cushioning member **852** can be in a range of about 70 percent to about 95 percent of the rear spacing volume **874**.

FIGS. **25-27** show another embodiment of an article of footwear **900**. In many aspects, the article of footwear **900** is similar to the article of footwear **100** described above and similar numbering in the **900** series is used for the article of footwear **900**. For example, the article of footwear **900** includes an upper **902**, a top portion **920**, and a sole structure **904** with an outsole **930**. The upper **902** defines a forefoot region **908**, a midfoot region **910**, and a heel region **912**. Further, the article of footwear **900** also includes a medial side **916** corresponding to an inside portion of the article of footwear **900** and a lateral side **918** corresponding to an outside portion of the article of footwear **900**.

Further, the outsole **930** may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **904**. The outsole **930** may comprise a PU plastic, such as a TPU material, for example. Other thermoplastic elastomers consisting of block copolymers are also possible. In other embodiments, the outsole **930** can include carbon fiber or high-density wood, for example. The outsole **930** can also include any combination of ground engaging members (e.g., spikes **944**, teeth **946**, and barbs **948**) extending from the outsole **930** to aid in traction.

In some aspects, however, the articles of footwear **100**, **900** differ from each other. For example, the outsole **930** includes an upper outsole **930**A and a lower outsole **930**B. The upper outsole **930**A extends along the top portion **920** and can be attached thereto. The upper outsole **930**A extends from the forefoot region **908** through the heel region **912** and from the medial side **916** to the lateral side **918**. The upper outsole **930**A has a front portion **932**, a middle portion **934**, and a rear portion **936**. In some embodiments, the upper outsole **930**A can have a uniform thickness.

The lower outsole **930**B extends from and along the upper outsole **930**A. In some embodiments, the outsole **930**, including the upper outsole **930**A and the lower outsole **930**B, can be integrally formed as a continuous and unitary structure. The lower outsole **930**B has a front portion **962**, a middle portion **964**, and a rear portion **966**. In some embodiments, the lower outsole **930**B can have a uniform thickness. In some embodiments, the lower outsole **930**B can have a thickness substantially the same as the thickness of the upper outsole **930**A.

In FIGS. **25** and **27**, the article of footwear **900** is shown in a rested or unloaded state. The lower outsole **930**B has a cross-like shape with a center section **980** and is connected to the upper outsole **932** at locations at the front portion **962** of the article of footwear **900** at a forefoot coupling point **976**A and at the medial and lateral sides **916**, **918** in the forefoot region **908** at a medial coupling point **984** and a lateral coupling point **986**, respectively. However, it is contemplated that the lower outsole **930**B can be attached to the upper outsole **930**A in other locations, including, for example, around the periphery of the front portion **932** of the upper outsole **930**A. The middle portion **964** of the lower outsole **930**B can also be attached to the middle portion **934** of the upper outsole **930**A in the midfoot region **910** of the article of footwear **900** at a midfoot coupling point **978**. The lower outsole **930**B is spaced from the upper outsole **930**A between the forefoot coupling point **976**, the medial coupling point **984**, the lateral coupling point **986**, and the midfoot coupling point **978**, defining a front spacing **940**. The front spacing **940** has a first longitudinal length **922** defined as a straight line distance between the coupling points of the upper outsole **930**A and the lower outsole **930**B at the forefoot region **908** and at the midfoot region **910**. The front spacing **940** also has a latitudinal width **982** defined as a straight line distance between the coupling points of the upper outsole **930**A and the lower outsole **930**B at the medial and lateral sides **916**, **918** (see FIG. **26**). In the embodiment shown, when looking from the side (see FIG. **25**), the front spacing **940** has a crescent profile, which has a curved length **924** defined as a curved line following the midpoint between the upper outsole **930**A and the lower outsole **930**B along the first longitudinal length **922** and between the forefoot coupling point **976** and the midfoot coupling point **978**. The front spacing **940** also has a first gap height **926** defined by the distance between the upper outsole **920**A and the lower outsole **930**B.

The first gap height **926** is largest at the center section **980**, defining a maximum first gap height **980**A, and decreases moving outward from the center section **980** along the first longitudinal length **922** and along the latitudinal width **982**. The front spacing **940** also has a front spacing

volume **928** as defined by the upper outsole **920**A, the lower outsole **930**B, and an unseen boundary extending from and between the periphery of the lower outsole **920**B and the upper outsole **930**A.

As illustrated in FIGS. **25** and **27**, the middle portion **964** of the lower outsole **930**B extends away from the middle portion **934** of the upper outsole **930**A at the connection point in midfoot region **910**. The rear portion **966** of the lower outsole **930**B is spaced from the rear portion **936** of the upper outsole **930**A, defining a rear spacing **942** between the rear portions **936**, **966**. When viewed from the side, the rear spacing **942** has a wedge profile. As shown, the rear spacing **942** has a second longitudinal length **970** defined as a straight line distance between the midfoot coupling point **978** and a terminal end **960** of the rear portion **936** of the lower outsole **930**B. The rear spacing **942** also has a second gap height **972** defined by the distance between the upper outsole **930**A and the lower outsole **930**B along the second longitudinal length **970**. The second gap height **972** increases from the midfoot region **910** toward the heel region **912** along the second longitudinal length **970** and is substantially constant along the heel region **912** beneath where the heel of a user's foot would be received within the upper **902**. The greatest height of the second gap height **972** defines a maximum second gap height **972**A. The rear spacing **942** also has a rear spacing volume **974** as defined by the upper outsole **930**A, the lower outsole **930**B, and an unseen boundary extending from and between the periphery of the lower outsole **930**B and the upper outsole **930**A in the heel region **912**.

In the rested state, the first longitudinal length **922** of the article of footwear **900** is greater than the second longitudinal length **970**, and the maximum first gap height **926** is smaller than the maximum second gap height **972**. In some embodiment, the maximum second gap height **972**A can be in a range from about 2.0 times to about 3.0 times the maximum first gap height **926**A. In some embodiments, the first longitudinal length **922** can be in a range from about 1.5 times to about 2.0 times the second longitudinal length **970**. In some embodiments, the front spacing volume is approximately the same as the rear spacing volume.

In a neutral state (not shown), when a user's foot is received within the upper **902** and the user is standing (i.e., no downward force is being applied to the article of footwear **900** other than the weight of the user), the front spacing volume **928** decreases due to the upper outsole **930**A being urged toward the lower outsole **930**B under the force of the weight of the user. In some embodiments, for example, the percentage decrease in the front spacing volume **928** from the rested state to the neutral state can be in a range of about 1 percent to about 20 percent, more preferably the percentage decrease in the front spacing volume **928** can be in a range of about 5 percent to about 10 percent. Additionally, the rear spacing volume **974** will be decreased in the neutral state. In some embodiments, for example, the percentage decrease of the rear spacing volume **974** from the rested state to the neutral state can be in a range of about 1 percent to about 50 percent, more preferably the percentage decrease in the rear spacing volume **974** can be in a range of about 10 percent to about 30 percent. Further, the middle portion **964** of the lower outsole **930**B contacts the upper outsole **930**A in the midfoot region **910** and provides additional support of the arch of the user when in the neutral state.

During use, in an active state, when the lower outsole **930**B is in contact with the ground and a user exerts a downward force in the forefoot region **908**, the downward force will urge the upper outsole **930**A toward the lower

outsole **930**B and further decrease the front spacing volume **928** while lengthening the first longitudinal length **922** and the latitudinal width **982**. In some embodiments, for example, the percentage decrease in the front spacing volume **928** from the rested state to the active state can be in a range of about 10 percent to about 100 percent, more preferably, the percentage decrease in the front spacing volume **928** can be in a range of about 50 percent to about 90 percent. Additionally, in the active state, if a user applies a force to the heel portion **912**, the rear spacing volume **974** will experience a percentage decrease from the rested state. For example, the percentage decrease can be in a range of about 90 percent to about 100 percent. Further, the middle portion **964** of the lower outsole **930**B can act as a fulcrum when in the active state. For example, a user can strike the heel portion **912** on the ground while walking or running and rotate the foot forward about the middle portion **964** in the midfoot region **910**, and continue rotating the foot forward, striking the forefoot region **908** on the ground.

The configuration of the outsole **930**, with the front spacing **940** and rear spacing **942** provided between the upper outsole **930**A and the lower outsole **930**B, can provide force absorption as a user exerts downward force onto the forefoot region **908** and the heel region **912**, respectively, of the article of footwear **900** and can also provide a spring effect as the downward force from the user is relieved. This can reduce the severity of the impact to a user's foot and leg joints during use.

As stated above, some combination of ground engaging members (e.g., spikes **944**, teeth **946**, and barbs **948**) can be provided on the outsole **930**. Looking at FIG. **26**, the distribution of spikes **944**, teeth **946**, and barbs **948** can be on both the upper outsole **930**A and the lower outsole **930**B. For example, spikes **944** and barbs **948** can extend from bottom surfaces **938**, **968** of the upper and lower outsoles **930**A, **930**B at the front portions **932**, **962**. Teeth **946** can be provided around the periphery of the front portion **932** of the upper outsole **930**A and barbs **948** can extend from the bottom surface **968** of the lower outsole **930**B at the rear portion **966**

FIGS. **28-30** show another embodiment of an article of footwear **1000**. In many aspects, the article of footwear **1000** is similar to the article of footwear **900** described above and similar numbering in the **1000** series is used for the article of footwear **900**. For example, the article of footwear **1000** includes an upper **1002**, a top portion **1020**, and a sole structure **1004** with an outsole **1030**. The outsole **1030** may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **1004**. The outsole **1030** has an upper outsole **1030**A and a lower outsole **1030**B. The upper outsole **1030**A has a front portion **1032**, a middle portion **1034**, and a rear portion **1036** and the lower outsole **1030**B has a front portion **1062**, a middle portion **1064**, a rear portion **1066** with a terminal end **1060**, and has a cross-like shape with a center section **1080**. The upper **1002** defines a forefoot region **1008**, a midfoot region **1010**, and a heel region **1012**. The upper and lower outsoles **1030**A, **1030**B define a front spacing **1040**, a first longitudinal length **1022**, a latitudinal width **1082**, a curved length **1024**, a first gap height **1026** with a maximum first gap height **1026**A, a front spacing volume **1028**, a rear spacing **1042**, a second longitudinal length **1070**, a second gap height **1072** with a maximum second gap height **1072**A, and a rear spacing volume **1074**. Further, the article of footwear **1000** also includes a medial side **1016** corresponding to an inside portion of the article of footwear **1000** and a lateral side

1018 corresponding to an outside portion of the article of footwear **1000**. The lower outsole **1030**B can be coupled to the upper outsole **1030**A at a forefoot coupling point **1076**, a medial coupling point **1084**, a lateral coupling point **1086**, and a midfoot coupling point **1078**. Additionally, at least one ground engaging member (e.g., a spike **1044**, a tooth **1046**, or a barb **1048**) can extend from either or both bottom surfaces **1038**, **1068** of the upper and lower outsoles **1030**A, **1030**B.

In some aspects, however, the articles of footwear **900**, **1000** differ from each other. For example, the sole structure **1004** includes a front cushioning member **1050**. The front cushioning member **1050** may be positioned within the front spacing **1040** between the lower outsole **1030**B and the upper outsole **1030**A and can extend across the front portion **1062** of the lower outsole **1030**B. In some embodiments, for example, the volume of the front cushioning member **1050** can be in a range of about 85 percent to about 95 percent of the front spacing volume **1028**. The front cushioning member **1050** can be formed from any of the materials and processes described above with respect to the front cushioning member **250** of the article of footwear **200**.

The sole structure **1004** as described with the front cushioning member **1050** provided within the front spacing **1040** of the outsole **1030** can provide spring and dampening properties. This can reduce the severity of the impact to a user's foot and leg joints during use. It is contemplated that the location of the lowest point of the center section **1080** (e.g., at the location of the maximum first gap height **1026**A) can be positioned within the outsole **1030** depending on the running behavior of the athlete, such that the lowest point is always the first ground contact spot. Doing so can bundle the force and energy in a single spot rather than distributing the energy and force over the width of the outsole **1030**. This could be especially beneficial for runners with flat feet or similar foot issues

FIGS. **31-33** show another embodiment of an article of footwear **1100**. In many aspects, the article of footwear **1100** is similar to the article of footwear **1000** described above and similar numbering in the **1100** series is used for the article of footwear **1100**. For example, the article of footwear **1100** includes an upper **1102**, a top portion **1120**, and a sole structure **1104** with an outsole **1130**. The outsole **1130** may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **1104**. The outsole **1130** has an upper outsole **1130**A and a lower outsole **1130**B. The upper outsole **1130**A has a front portion **1132**, a middle portion **1134**, and a rear portion **1136** and the lower outsole **1030**B has a front portion **1162**, a middle portion **1164**, and a rear portion **1166** with a terminal end **1160**, and has a cross-like shape with a center section **1180**. The upper **1102** defines a forefoot region **1108**, a midfoot region **1110**, and a heel region **1112**. The upper and lower outsoles **1130**A, **1130**B define a front spacing **1140**, a first longitudinal length **1122**, a latitudinal width **1182**, a curved length **1124**, a first gap height **1126** with a maximum first gap height **1126**A, a front spacing volume **1128**, a rear spacing **1142**, a second longitudinal length **1170**, a second gap height **1172** with a maximum second gap height **1172**A, and a rear spacing volume **1174**. Further, the article of footwear **1100** also includes a medial side **1116** corresponding to an inside portion of the article of footwear **1100** and a lateral side **1118** corresponding to an outside portion of the article of footwear **1100**. The lower outsole **1130**B can be coupled to the upper outsole **1130**A at a forefoot coupling point **1176**, a medial coupling point **1184**, a lateral coupling point **1186**, and a midfoot coupling point **1178**. Additionally, at least one ground engaging member (e.g., a spike **1144**, a tooth **1146**, or a barb **1148**) can extend from either or both bottom surfaces **1138**, **1168** of the upper and lower outsoles **1130**A, **1130**B.

Further, the sole structure **1104** includes a front cushioning member **1150**. The front cushioning member **1150** is positioned within the front spacing **1140** between the lower outsole **1130**B and the upper outsole **1130**A and extends across the lower outsole **1130**B. The front cushioning member **1150** can be formed from any of the materials and processes described above with respect to the front cushioning member **250** of the article of footwear **200**.

In some aspects, however, the articles of footwear **1000**, **1100** differ from each other. For example, the sole structure **1104** includes a rear cushioning member **1152** similar to that of the front cushioning member **1050** in the article of footwear **1000**. The rear cushioning member **1152** may be positioned within the rear spacing **1142** between the lower outsole **1130**B and the upper outsole **1130**A. The rear cushioning member **1152** extends across a portion of the rear portion **1166** of the lower outsole **1130**B. In some embodiments, for example, the volume of the rear cushioning member **1152** can be in a range of about 35 percent to about 50 percent of the rear spacing volume **1174**. In some embodiments, the rear cushioning member **1152** can define a rear spacing pocket **1154** adjacent the front side of the rear cushioning member **1152**. The rear spacing pocket **1154** extends longitudinally between the midfoot coupling point **1178** and the rear cushioning member **1152**, latitudinally between the medial side **1116** and the lateral side **1118**, and vertically between the upper outsole **1130**A and the lower outsole **1130**B. As shown in FIGS. **31** and **33**, the rear cushioning member **1152** is positioned directly beneath where the heel of a user's foot would be received within the upper **1102**. For example, the rear cushioning member **1152** is positioned within the rear spacing pocket **1154** at the location of and adjacent the maximum second gap height **1172**A. The rear cushioning member **1152** can be formed from any of the materials and processes described above with respect to the front cushioning member **250** of the article of footwear **200**.

The sole structure **1104** as described with the front cushioning member **1150** provided within the front spacing **1140** of the outsole **1130** and the rear cushioning member **1152** provided within the rear spacing **1142** of the outsole **1130** can provide spring and dampening properties, which can reduce the severity of the impact to a user's foot and leg joints during use.

FIGS. **34-48** show other embodiments of an article of footwear **1200**, **1300**, **1400**, **1500**, **1600**. In many aspects, the articles of footwear **1200**, **1300**, **1400**, **1500**, **1600** are similar to the articles of footwear **900**, **1000**, **1100** described above and similar numbering in the **1200**, **1300**, **1400**, **1500**, **1600** series is used for the articles of footwear **1200**, **1300**, **1400**, **1500**, **1600**. For example, each of the articles of footwear **1200**, **1300**, **1400**, **1500**, **1600** include an upper **1202**, **1302**, **1402**, **1502**, **1602**; a top portion **1220**, **1320**, **1420**, **1520**, **1620**; and a sole structure **1204**, **1304**, **1404**, **1504**, **1604** with an outsole **1230**, **1330**, **1430**, **1530**, **1630**. Each outsole **1230**, **1330**, **1430**, **1530**, **1630** may be a rigid plate and has an upper outsole **1230**A, **1330**A, **1430**A, **1530**A, **1630**A with a front portion **1232**, **1332**, **1432**, **1532**, **1632**; a middle portion **1234**, **1334**, **1434**, **1534**, **1634**; and a rear portion **1236**, **1336**, **1436**, **1536**, **1636** and a lower outsole **1230**B, **1330**B, **1430**B, **1530**B, **1630**B with a front portion **1262**, **1362**, **1462**, **1562**, **1662**; a middle portion **1264**, **1364**, **1464**, **1564**, **1664**; and a rear portion **1266**,

1366, **1466**, **1566**, **1666** with a terminal end **1260**, **1360**, **1460**, **1560**, **1660**. The upper outsole **1230**A, **1330**A, **1430**A, **1530**A, **1630**A extends along the top portion **1220**, **1320**, **1420**, **1520**, **1620** and can be attached thereto. The lower outsole **1230**B, **1330**B, **1430**B, **1530**B, **1630**B having a cross-like shape with a center section **1280**, **1380**, **1480**, **1580**, **1680**. Additionally, each article of footwear **1200**, **1300**, **1400**, **1500**, **1600** defines a forefoot region **1208**, **1308**, **1408**, **1508**, **1608**; a midfoot region **1210**, **1310**, **1410**, **1510**, **1610**; and a heel region **1212**, **1312**, **1412**, **1512**, **1612** and has a medial side **1216**, **1316**, **1416**, **1516**, **1616** and a lateral side **1218**, **1318**, **1418**, **1518**, **1618**. The lower outsole **1230**B, **1330**B, **1430**B, **1530**B, **1630**B can be coupled to the upper outsole **1230**A, **1330**A, **1430**A, **1530**A, **1630**A at a forefoot coupling point **1276**, **1376**, **1476**, **1576**, **1676**; a medial coupling point **1284**, **1384**, **1484**, **1584**, **1684**; a lateral coupling point **1286**, **1386**, **1486**, **1586**, **1686**; and a midfoot coupling point **1278**, **1378**, **1478**, **1578**, **1678**.

Further, each article of footwear **1200**, **1300**, **1400**, **1500**, **1600** defines a front spacing **1240**, **1340**, **1440**, **1540**, **1640**; a first longitudinal length **1222**, **1322**, **1422**, **1522**, **1622**; latitudinal width **1282**, **1382**, **1482**, **1582**, **1682**; a curved length **1224**, **1324**, **1424**, **1524**, **1624**; a first gap height **1226**, **1326**, **1426**, **1526**, **1626** with a maximum first gap height **1226**A, **1326**A, **1426**A, **1526**A, **1626**A; a front spacing volume **1228**, **1328**, **1428**, **1528**, **1628**; a rear spacing **1242**, **1342**, **1442**, **1542**, **1642**; a second longitudinal length **1270**, **1370**, **1470**. **1570**, **1670**; a second gap height **1272**, **1372**, **1472**, **1572**, **1672** with a maximum second gap height **1272**A, **1372**A, **1472**A, **1572**A, **1672**A; and a rear spacing volume **1274**, **1374**, **1474**, **1574**, **1674**. Each article of footwear **1200**, **1300**, **1400**, **1500**, **1600** also has at least one ground engaging member (e.g., a spike **1244**, **1344**, **1444**, **1544**, **1644**; a tooth **1246**, **1346**, **1446**, **1546**, **1646**; or a barb **1248**, **1348**, **1448**, **1548**) extending from at least one of a bottom surface **1238**, **1338**, **1438**, **1538**, **1638** of the upper outsole **1230**A, **1330**A, **1430**A, **1530**A, **1630**A or a bottom surface **1268**, **1368**, **1468**, **1568**, **1668** of the lower outsole **1230**B, **1330**B, **1430**B, **1530**B, **1630**B. However, each embodiment differs in the inclusion and arrangement of the front and rear cushioning members. When included, however, the materials comprising and processes for making the front and rear cushioning members are as described above.

In FIGS. **34-36**, illustrating the article of footwear **1200**, both a front cushioning member **1250** and a rear cushioning member **1252** are provided. The front cushioning member **1250** is positioned within the front spacing **1240** between the lower outsole **1230**B and the upper outsole **1230**A and extends across the front portion **1262** of the lower outsole **1230**B. In some embodiments, for example, the volume of the front cushioning member **1250** can be in a range of about 85 percent to about 95 percent of the front spacing volume **1228**. Further, the rear cushioning member **1252** is positioned within the rear spacing **1242** between the lower outsole **1230**B and the upper outsole **1230**A and extends across the rear portion **1266** of the lower outsole **1230**B. In some embodiments, for example, the volume of the rear cushioning member **1252** can be in a range of about 70 percent to about 95 percent of the rear spacing volume **1274**.

In FIGS. **37-39**, the article of footwear **1300** is shown with both a front cushioning member **1350** and a rear cushioning member **1352**. The front cushioning member **1350** is positioned within the front spacing **1340** between the lower outsole **1330**B and the upper outsole **1330**A and extends across a portion of the front portion **1362** of the lower outsole **1330**B. In some embodiments, for example, the volume of the front cushioning member **1350** can be in a range of about 35 percent to about 50 percent of the front spacing volume **1328**. In some embodiments, the front cushioning member **550** can define a first front spacing pocket **1356** and a second front spacing pocket **1358** adjacent the front and rear sides of the front cushioning member **1350**, respectively. The first front spacing pocket **1356** extends longitudinally between the forefoot coupling point **1376** and the front cushioning member **1350**, latitudinally between the medial side **1316** and the lateral side **1318**, and vertically between the upper outsole **1330**A and the lower outsole **1330**B. The second front spacing pocket **1358** extends longitudinally between the front cushioning member **1350** and the midfoot coupling point **1378**, latitudinally between the medial side **1316** and the lateral side **1318**, and vertically between the upper outsole **1330**A and the lower outsole **1330**B. As shown, the front cushioning member **1350** can be positioned directly beneath where the ball of a user's foot would be received within the upper **1302**. For example, the front cushioning member **1350** is positioned within the front spacing pocket **1356** at the location of and adjacent the maximum first gap height **1326**A. Further, the rear cushioning member **1352** is positioned within the rear spacing **1342** between the lower outsole **1330**B and the upper outsole **1330**A and extends across the rear portion **1366** of the lower outsole **1330**B. In some embodiments, for example, the volume of the rear cushioning member **1352** can be in a range of about 70 percent to about 95 percent of the rear spacing volume **1374**.

FIGS. **40-42** show the article of footwear **1400** with both a front cushioning member **1450** and a rear cushioning member **1452**. The front cushioning member **1450** is positioned within the front spacing **1440** between the lower outsole **1430**B and the upper outsole **1430**A and extends across a portion of the front portion **1462** of the lower outsole **1430**B. In some embodiments, for example, the volume of the front cushioning member **1450** can be in a range of about 35 percent to about 50 percent of the front spacing volume **1428**. In some embodiments, the front cushioning member **1450** can define a first front spacing pocket **1456** and a second front spacing pocket **1458** adjacent the front and rear sides of the front cushioning member **1450**, respectively. The first front spacing pocket **1456** extends longitudinally between the forefoot coupling point **1476** and the front cushioning member **1450**, latitudinally between the medial side **1416** and the lateral side **1418**, and vertically between the upper outsole **1430**A and the lower outsole **1430**B. The second front spacing pocket **1458** extends longitudinally between the front cushioning member **1450** and the midfoot coupling point **1478**, latitudinally between the medial side **1416** and the lateral side **1418**, and vertically between the upper outsole **1430**A and the lower outsole **1430**B. As shown, the front cushioning member **1450** can be positioned directly beneath where the ball of a user's foot would be received within the upper **1402**. For example, the front cushioning member **1450** is positioned within the front spacing pocket **1456** at the location of and adjacent the maximum first gap height **1426**A. The rear cushioning member **1452** is positioned within the rear spacing **1442** between the lower outsole **1430**B and the upper outsole **1430**A. The rear cushioning member **1452** extends across a portion of the rear portion **1466** of the lower outsole **1430**B. In some embodiments, for example, the volume of the rear cushioning member **1452** can be in a range of about 35 percent to about 50 percent of the rear spacing volume **1474**. In some embodiments, the rear cushioning member **1452** can define a rear spacing pocket **1454** adjacent the front side of the rear cushioning member **1452**.

The rear spacing pocket **1454** extends longitudinally between the midfoot coupling point **1478** and the rear cushioning member **1452**, latitudinally between the medial side **1416** and the lateral side **1418**, and vertically between the upper outsole **1430**A and the lower outsole **1430**B. As shown, the rear cushioning member **1452** is positioned directly beneath where the heel of a user's foot would be received within the upper **1402**. For example, the rear cushioning member **1452** is positioned within the rear spacing pocket **1454** at the location of and adjacent the maximum second gap height **1472**A.

The article of footwear **1500** is shown in FIGS. **43-45**. The article of footwear **1500** does not have a front cushioning member within the front spacing **1540** but does have a rear cushioning member **1552** within the rear spacing **1542**. The rear cushioning member **1552** is positioned within the rear spacing **1542** between the lower outsole **1530**B and the upper outsole **1530**A. The rear cushioning member **1552** extends across a portion of the rear portion **1566** of the lower outsole **1530**B. In some embodiments, for example, the volume of the rear cushioning member **1552** can be in a range of about 35 percent to about 50 percent of the rear spacing volume **1574**. In some embodiments, the rear cushioning member can define a rear spacing pocket **1554** adjacent the front side of the rear cushioning member **1552**. The rear spacing pocket **1554** extends longitudinally between the midfoot coupling point **1578** and the rear cushioning member **1552**, latitudinally between the medial side **1516** and the lateral side **1518**, and vertically between the upper outsole **1530**A and the lower outsole **1530**B. As shown, the rear cushioning member **1552** is positioned directly beneath where the heel of a user's foot would be received within the upper **1502**. For example, the rear cushioning member **1552** is positioned within the rear spacing pocket **1554** at the location of and adjacent the maximum second gap height **1572**A.

FIGS. **46-48** illustrate the article of footwear **1600**. The article of footwear **1600** does not have a front cushioning member within the front spacing **1640** but does have a rear cushioning member **1652** within the rear spacing **1642**. The rear cushioning member **1652** is positioned within the rear spacing **1642** between the lower outsole **1630**B and the upper outsole **1630**A and extends across the rear portion **1666** of the lower outsole **1630**B. In some embodiments, for example, the volume of the rear cushioning member **1652** can be in a range of about 70 percent to about 95 percent of the rear spacing volume **1674**.

FIGS. **49-59** illustrates the article of footwear **1700**. In many aspects, the article of footwear **1700** is similar to the article of footwear **1400** described above and similar numbering in the **1700** series is used for the article of footwear **1700**. For example, the article of footwear **1700** can include an upper **1702** (see FIGS. **54-59**), a top portion **1720**, and a sole structure **1704** with an outsole **1730**. The upper **1702** defines a forefoot region **1708**, a midfoot region **1710**, and a heel region **1712**. Further, the article of footwear **1700** also includes a medial side **1716** corresponding to an inside portion of the article of footwear **1700** and a lateral side **1718** corresponding to an outside portion of the article of footwear **1700**. Additionally, the sole structure **1704** includes an outsole **1730**, which may be a rigid plate formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **1704**. The outsole **1730** has an upper outsole **1730**A and a lower outsole **1730**B, the space therebetween in the forefoot and heel regions **1708**, **1712** defining a front spacing **1740** and a rear spacing **1742**, respectively. The upper outsole **1730**A has a front portion **1732**, a middle portion **1734**, and a rear portion **1736** and the lower outsole **1730**B has a front portion **1762**, and a rear portion **1766**. The upper outsole **1730** extends along the top portion **1720** and can be attached thereto. A front cushioning member **1750** is located in the front spacing **1740**, and the front spacing **1740** further defines a first longitudinal length **1722**, a curved length **1724**, a first gap height **1726** with a maximum first gap height **1726**A, and a front spacing volume **1728**. A rear cushioning member **1752** is located in the rear spacing **1742**, and the rear spacing **1742** further defines a second longitudinal length **1770**, a second gap height **1772** with a maximum second gap height **1772**A, and a rear spacing volume **1774**.

In some aspects, however, the articles of footwear **1700**, **1400** differ from each other. For example, the lower outsole **1730**B is formed from a front lower outsole segment **1790** and a rear lower outsole segment **1792** coupled to the upper outsole **1730**A at the front portion **1732** and the rear portion **1736**, respectively. Further, at least one ground engaging member (e.g., a large spike **1744** or a small spike **1794**) can extend from the bottom surface **1768** of the lower outsole **1730**B.

Additionally, the structure of the outsole **1730**, including the coupling of the upper and lower outsoles **1730**A, **1730**B, is different. For example, the front lower outsole segment **1790** of the lower outsole **1730**B extends outward from the periphery of the front portion **1732** of the upper outsole segment **1730**A and curves downward and then inward to extend at least partially beneath the upper outsole **1730**A to form the front spacing **1740**. In some embodiments, the front lower outsole segment **1790** can be formed as a set of fingers, or claws **1790**A (e.g., lobes), that do not extend across the entire front spacing **1740** as shown in FIGS. **49-51**. Further, the front spacing volume **1728** is defined by the upper outsole **1730**A, the front lower outsole segment **1790**, and an unseen boundary extending from and between the set of claws of the front lower outsole segment **1790**. The front cushioning member **1750** is located at least substantially within the front spacing **1740**, encased by the set of claws **1790**A. In some embodiments, the front cushioning member **1750** can extend beyond the front spacing **1742** toward the rear portion **1736**. In some embodiments, for example, the volume of the front cushioning member **1750** can be in a range of about 50 percent to about 75 percent of the front spacing volume **1728**. In some embodiments, the front cushioning member **1750** can define a front spacing pocket **1756** between the curved portions of the front lower outsole segment **1790** and the periphery of the front cushioning member **1750**. In some embodiments, the front cushioning member **1750** can extend downward between the set of fingers and in line with the front lower outsole segment **1790** (see FIGS. **52** and **55-57**).

Looking at the rear lower outsole segment **1792**, some differences from the lower outsole **1430**B of the article of footwear **1400** are also present. The rear lower outsole segment **1792** of the lower outsole **1730**B extends outward from the periphery of the rear portion **1736** of the upper outsole segment **1730**A and curves downward and then inward to extend at least partially beneath the upper outsole **1730**A to form the rear spacing **1742**. In some embodiments, the rear lower outsole segment **1792** can be formed as a set of fingers, or claws **1792**A, that do not extend across the entire rear spacing **1742** as shown in FIGS. **49-51**. Further, the rear spacing volume **1774** is defined by the upper outsole **1730**A, the rear lower outsole segment **1792**, and an unseen boundary extending from and between the set of claws

1792A of the rear lower outsole segment **1792**. The rear cushioning member **1752** is received within the rear spacing **1744**. In some embodiments, the rear cushioning member **1752** can extend beyond the rear spacing **1744** toward the front portion **1732**. In some embodiments, for example, the volume of the rear cushioning member **1752** can be in a range of about 50 percent to about 75 percent of the rear spacing volume **1774**. In some embodiments, the rear cushioning member **1752** can define a rear spacing pocket **1754** between the curved portions of the rear lower outsole segment **1792** and the periphery of the rear cushioning member **1752**. In some embodiments, the rear cushioning member **1752** can extend downward between the set of fingers and in line with the rear lower outsole segment **1792** (see FIGS. **53** and **59**).

While running, the sets of claws **1790**A, **1792**A can partially collapse into the front cushioning member **1750** and the rear cushioning member **1752**, respectively. The resiliency of the front and rear cushioning members **1750**, **1752** and the sets of claws **1790**A, **1792**A, can provide additional energy return to a user. Each of the claws of the sets of claws **1790**A, **1792**A can be independently movable relative to the other claws.

Additionally, or alternatively, the sets of claws **1790**A, **1792**A can be coupled together via an additional plate (not shown) positioned between the front and rear cushioning members **1750**, **1752** and the sets of claws **1790**A, **1792**A. The plate can be formed from a material such as TPU. While running, the sets of claws **1790**A, **1792**A can collapse into the plate and displace the force across the front and rear cushioning members **1750**, **1752**.

FIGS. **49-51** and **58** further illustrate the upper outsole **1730**A including a set of ribs **1796** protruding downward from a bottom surface **1738** of the upper outsole **1730** and extending from the front portion **1732** to the rear portion **1736**. The set of ribs **1796** add rigidity to the upper outsole **1730**A and can further aid in supporting the arch of a user's foot.

FIGS. **60-62** illustrate another embodiment of an article of footwear **1800**. In many aspects, the article of footwear **1800** is similar to the article of footwear **600** described above and similar numbering in the **1800** series is used for the article of footwear **1800**. For example, the article of footwear **1800** can include an upper **1802** (see FIG. **62**), a top portion **1820**, and a sole structure **1804** with an outsole **1830** spaced from the top portion **1820**. The space between the top portion **1820** and the outsole **1830** in the forefoot and heel regions **1808**, **1812** defining a front spacing **1840** and a rear spacing **1842**, respectively. The upper **1802** defines a forefoot region **1808**, a midfoot region **1810**, and a heel region **1812**. Further, the article of footwear **1800** includes a medial side **1816** corresponding to an inside portion of the article of footwear **1800** and a lateral side **1818** corresponding to an outside portion of the article of footwear **1800**. Further, the outsole **1830** may be a rigid plate and has a front portion **1832**, a middle portion **1834**, and a rear portion **1836** with a terminal end **1860**. The outsole **1830** can be coupled to the top portion **1820** at a midfoot coupling point **1878**. A front cushioning member **1850** is located in the front spacing **1840**, which further defines a first longitudinal length **1822**, a curved length **1824**, a first gap height **1826** with a maximum first gap height **1826**A, a front spacing volume **1828**, a first front spacing pocket **1856**, and a second front spacing pocket **1858**. A rear cushioning member **1852** is located in the rear spacing **1842**, which further defines a second longitudinal length **1870**, a second gap height **1872** with a maximum second gap height **1872**A, a rear spacing volume **1874**, and a rear spacing pocket **1854**. Further, spikes **1844** and teeth **1846** extend downward from a bottom surface **1838** of the outsole **1830**.

In some aspects, however, the articles of footwear **1800**, **600** differ from each other. For example, the front portion **1832** of the outsole **1830** extends beyond the top portion **1820** defining a toe gap **1898**. Further, a set of small spikes **1894** can also extend from the bottom surface **1838** of the outsole **1830**. As shown, the set of small spikes **1894** are provided in the front portion **1832** and the rear portion **1836**, but other arrangements are contemplated, including having the set of small spikes **1894** in only one of either the front portion **1832** or the rear portion **1836**. Additionally, the outsole **1830** includes a set of ribs **1896** protruding downward from the bottom surface **1838** of the outsole **1830** and extending from the front portion **1832** to the rear portion **1836**. The set of ribs **1896** add rigidity to the outsole **1830** and can further aid in supporting the arch of a user's foot.

FIGS. **63-67** illustrate another embodiment of an article of footwear **1900**. In many aspects, the article of footwear **1900** is similar to the article of footwear **1700** described above and similar numbering in the **1900** series is used for the article of footwear **1900**. For example, the article of footwear **1900** can include an upper **1902** (see FIG. **66**), a top portion **1920**, and a sole structure **1904** with an outsole (first outsole segment **1930**A) spaced from the top portion **1920**. The first outsole segment **1930**A extends along the top portion **1932** and can be attached thereto. The upper **1902** defines a forefoot region **1908**, a midfoot region **1910**, and a heel region **1912** (see FIG. **66**). Further, the article of footwear **1900** also includes a medial side **1916** corresponding to an inside portion of the article of footwear **1900**. Additionally, the first outsole segment **1930**A has a front portion **1932**, a middle portion **1934**, and a rear portion **1936**.

Continuing, the front portion **1932** of the first outsole segment **1930**A in the forefoot region **1908** extends downward and then inward. The front portion **1932** of the first outsole segment **1930**A extends at least partially beneath the top portion **1920**. In some embodiments, the front portion **1932** can be formed as a set of fingers, or claws **1990**A (e.g., lobes), that do not extend across the entire front spacing **1940**.

In some aspects, however, the articles of footwear **1900**, **1700** differ from each other. For example, the article of footwear **1900** has a second outsole segment **1930**B with a front portion **1962**, a middle portion **1964**, and a rear portion **1966** with a terminal end **1960**. The front portion **1962** of the second outsole segment **1930**B is positioned adjacent and within the set of claws **1990**A and beneath the top portion **1940**. The set of claws **1990**A of the first outsole segment **1930**A and the front portion **1962** of the second outsole segment **1930**B define a front spacing **1940**. The front spacing **1940** defines a first longitudinal length **1922**, a curved length **1924**, a first gap height **1926** with a maximum first gap height **1926**A, a front spacing volume **1928**, a first front spacing pocket **1956**, and a second front spacing pocket **1958**. A front cushioning member **1950** is located in the front spacing **1940**. The rear portion **1966** extends beneath the top portion **1920** in the heel region **1912** and defines a rear spacing **1942** therebetween. The rear spacing **1942** defines a second longitudinal length **1970**, a second gap height **1972** with a maximum second gap height **1972**A, a rear spacing volume **1974**, and a rear spacing pocket **1954**. The front portion **1962** is coupled to the front cushioning member **1950**, the middle portion **1964** can be coupled to the

top portion **1920** at a midfoot coupling point **1978** (see FIG. **66**), and the rear portion **1966** is coupled to a rear cushioning member **1952**.

Continuing, both the first outsole segment **1930**A and the second outsole segment **1930**B may be rigid plates formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **1904**. Further, as shown in the illustrated embodiment, a number of ground engaging members are provided on the first and second outsole segments **1930**A, **1930**B. Spikes **1944** and small spikes **1994** are provided extending from bottom surfaces **1938**, **1968**A in the front portions **1932**, **1962** of the first and second outsole segments **1930**A, **1930**B, and small spikes **1994** are provided extending from a bottom surface **1968**B in the rear portion **1966** of the second outsole segment **1930**B. It should be understood that other arrangements of ground engaging members, as described in the discussion of any of the other embodiments above, are contemplated.

In other embodiments, other configurations are possible. For example, certain features and combinations of features that are presented with respect to particular embodiments in the discussion above can be utilized in other embodiments and in other combinations, as appropriate. Further, any of the embodiments described herein may be modified to include any of the structures or methodologies disclosed in connection with other embodiments. Additionally, the present disclosure is not limited to articles of footwear of the type specifically shown. Still further, aspects of the articles of footwear of any of the embodiments disclosed herein may be modified to work with any type of footwear, apparel, or other athletic equipment.

As noted previously, it will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

INDUSTRIAL APPLICABILITY

Numerous modifications to the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the invention. The exclusive rights to all modifications which come within the scope of the appended claims are reserved.

We claim:

1. An article of footwear comprising:

an upper; and

a sole structure coupled to the upper and defining a ground engaging surface, the sole structure including:

a cushioning member coupled to the upper, and

an outsole coupled to the cushioning member, the outsole including a central portion extending across the sole structure from a lateral side to a medial side and a plurality of lobes extending outward from a periphery of the central portion, each of the plurality of lobes being independently movable relative to one another,

wherein the plurality of lobes includes a first plurality of lobes arranged along the medial side in a forefoot region and extending from the periphery of the central portion toward the medial side, and a second plurality of lobes arranged along a lateral side in the forefoot region and extending from the periphery of the central portion toward the lateral side, and

wherein the first plurality of lobes includes at least three lobes that define a first continuous undulation along the medial side of the sole structure and the second plurality of lobes includes at least three lobes that define a second continuous undulation along the lateral side of the sole structure.

2. The article of footwear of claim **1**, wherein the outsole includes a plurality of ground engaging elements including:

a plurality of removable spikes; and

a plurality of barbs that are integrally formed with the outsole.

3. The article of footwear of claim **2**, wherein each of the plurality of removable spikes include a conical tip and each of the plurality of barbs has a triangular pyramidal shape.

4. The article of footwear of claim **2**, wherein each of the plurality of lobes includes a single removable spike of the plurality of removable spikes and at least one barb of the plurality of barbs.

5. The article of footwear of claim **1**, wherein a first lobe of the first plurality of lobes is positioned directly across the central portion from a second lobe of the second plurality of lobes, the first lobe and the second lobe extending in opposite directions from one another at their respective connections with the central portion.

6. The article of footwear of claim **5**, wherein the plurality of lobes is positioned in a forefoot region of the sole structure.

7. The article of footwear of claim **1**, wherein the outsole defines an open area between the first plurality of lobes and the second plurality of lobes.

8. The article of footwear of claim **7**, wherein the cushioning member extends through the open area to define a portion of the ground engaging surface.

9. The article of footwear of claim **1**, wherein the outsole includes a rigid plate having:

a first portion in a forefoot region of the sole structure, the first portion extending across the forefoot region from a lateral side of the sole structure to a medial side of the sole structure,

a second portion in a midfoot region of the sole structure, and

a third portion in a heel region of the sole structure.

10. The article of footwear of claim **9**, wherein the second portion of the outsole includes a rib protruding from a bottom surface of the outsole, the rib extending in a direction between the first portion and the second portion of the outsole.

11. The article of footwear of claim **1**, wherein at least one of the plurality of lobes extends from a proximal end to a distal end, the proximal end being coupled to the central portion and positioned between the cushioning member and the upper, and the distal end positioned so that the cushioning member is between the distal end and the upper.

12. An article of footwear comprising:

an upper; and

a sole structure coupled to the upper and defining a ground engaging surface, the sole structure including:

a cushioning member coupled to the upper; and

an outsole coupled to the cushioning member, the outsole including a front outsole segment positioned in a fore-

foot region and a midfoot region, and a rear outsole segment positioned in a heel region and discontinuous with the front outsole segment along the ground engaging surface, the front outsole segment including a medial segment with a first plurality of lobes arranged along a medial side of the sole structure and a lateral segment with a second plurality of lobes arranged along a lateral side of the sole structure,

wherein each of the first plurality of lobes and the second plurality of lobes includes at least two lobes that are disposed entirely within the forefoot region such that the outsole has a continuously undulating peripheral edge extending around a toe end of the sole structure from a lateral side to a medial side, and

wherein the continuously undulating peripheral edge defines at least four inflection points along the lateral side and at least four inflection points along the medial side within the forefoot region and the midfoot region.

13. The article of footwear of claim **12**, wherein each lobe of the first plurality of lobes and the second plurality of lobes is independently moveable relative to one another to displace a force to the cushioning member.

14. The article of footwear of claim **12**, wherein the front outsole segment is discontinuous along the ground engaging surface between the lateral side and the medial side such that the front outsole segment defines an open area between the lateral segment and the medial segment.

15. The article of footwear of claim **14**, wherein the cushioning member extends across the open area.

16. The article of footwear of claim **12**, wherein the front outsole segment includes a plurality of first ground engaging elements and a plurality of second ground engaging elements that are shaped differently from the first ground engaging elements.

17. The article of footwear of claim **16**, wherein each of the first plurality of lobes and the second plurality of lobes includes a first ground engaging element of the plurality of first ground engaging elements.

18. The article of footwear of claim **16**, wherein the rear outsole segment includes a plurality of third ground engaging elements that are shaped similarly to the second ground engaging members.

19. The article of footwear of claim **12**, wherein the outsole includes:

a first portion in a forefoot region of the sole structure, the first portion extending across the forefoot region from a lateral side of the sole structure to a medial side of the sole structure, and

a second portion in the midfoot region of the sole structure, the second portion being devoid of lobes on at least one of the medial and the lateral side such that the second portion extends partially across the sole structure from the lateral side to the medial side.

20. The article of footwear of claim **19**, wherein the outsole includes a plurality of ribs extending in a direction between a heel region and the forefoot region.

21. A sole structure for an article of footwear including an upper, the sole structure comprising:

a cushioning member extending through each of a forefoot region, a midfoot region, and a heel region; and

an outsole that includes a plate coupled to the cushioning member, the plate including a front portion disposed in the forefoot region and extending though the midfoot region to a rear portion disposed in the heel region, the front portion including a first segment and a second segment extending outward from a periphery of the first segment so that the second segment bounds the first segment to define an outermost periphery of the plate along each of a lateral side and a medial side, the second segment formed as a plurality of lobes and including a medial segment arranged along the medial side and a lateral segment arranged along the lateral side,

wherein each of the medial segment and the lateral segment includes a first lobe defining a first peak, a second lobe directly connected to the first lobe and defining a second peak, and a valley between the first peak and the second peak such that the first lobe and the second lobe define an undulating peripheral edge of the outsole.

22. The article of footwear of claim **21**, wherein the first lobe and the second lobe are directly connected at the valley to define a single concave region between and bounded by the first peak and the second peak.

23. The article of footwear of claim **21**, wherein at least one of the medial segment and the lateral segment further includes a third lobe defining a third peak and a second valley between one of the first peak and the second peak to define a continuous extension of the undulating peripheral edge of the outsole.

24. The sole structure of claim **21**, wherein the plate extends continuously through each of the forefoot region, the midfoot region, and the heel region; and

wherein the second segment is disposed within the forefoot region.

25. The sole structure of claim **21**, wherein each of the plurality of lobes of the second segment is provided with one of a plurality of first ground engaging members and the first segment does not include the plurality of first ground engaging members.

26. The sole structure of claim **21**, wherein the first lobe and the second lobe of the medial segment extend outwardly from the first segment toward the medial side of the sole structure, and

wherein the first lobe and the second lobe of the lateral segment extend outwardly from the first segment toward the lateral side of the sole structure.

27. The sole structure of claim **26**, wherein the outsole defines an open area between the medial segment and the lateral segment, the cushioning member extending through the open area.

28. The sole structure of claim **27**, wherein the first lobe of the medial segment and the first lobe of the of lateral segment are arranged in an opposed configuration about the open area so that an apex of the first lobe of the medial segment is substantially aligned with an apex of the first lobe of the lateral segment along a longitudinal direction, and

wherein the second lobe of the medial segment and the second lobe of the lateral segment are arranged in an opposed configuration about the open area so that an apex of the second lobe of the medial segment is substantially aligned with an apex of the second lobe of the lateral segment along a longitudinal direction.

29. An article of footwear, comprising:

an upper; and

a sole structure coupled to the upper and defining a ground engaging surface, the sole structure including:

a cushioning member coupled to the upper and extending through each of a forefoot region, a midfoot region, and a heel region; and

an outsole including a rigid plate having:

a central segment;

a medial segment that bounds the central segment on a medial side of the sole structure to define an

outermost periphery of the outsole along the medial side, the medial segment including a first plurality of lobes extending from a medial periphery of the central segment toward a medial side of the sole structure, each of the first plurality of lobes including a medial ground engaging member; and

a lateral segment that bounds the central segment on a lateral side of the sole structure to define an outermost periphery of the outsole along the lateral side, the lateral segment including a second plurality of lobes extending from a lateral periphery of the central segment toward a lateral side of the sole structure, each of the second plurality of lobes including a lateral ground engaging member,

wherein an open area is defined between the lateral segment and the medial segment,

wherein the first plurality of lobes includes at least two lobes that define a first continuous undulation along the medial side of the sole structure and the second plurality of lobes includes at least two lobes that define a second continuous undulation along the lateral side of the sole structure,

wherein at least one of the first plurality of lobes is arranged in an opposed configuration with a corresponding one of the second plurality of lobes about the open area, and

wherein the cushioning member extends through the open area to define a portion of the ground engaging surface.

* * * * *

EXHIBIT D

US012016422B2

(12) **United States Patent**
Girard et al.

(10) **Patent No.: US 12,016,422 B2**
(45) **Date of Patent: Jun. 25, 2024**

(54) **ARTICLE OF FOOTWEAR HAVING A SOLE PLATE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

(72) Inventors: **Romain Girard**, Lauf an der Pegnitz (DE); **Andreas Siegismund**, Rueckersdorf (DE); **Mauro Bonin**, Nuremberg (DE)

(73) Assignee: **PUMA SE**, Herzogenaurach (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/101,992**

(22) Filed: **Jan. 26, 2023**

(65) **Prior Publication Data**

US 2023/0165336 A1 Jun. 1, 2023

Related U.S. Application Data

(63) Continuation of application No. 17/383,954, filed on Jul. 23, 2021.

(Continued)

(51) **Int. Cl.**
A43B 13/12 (2006.01)
A43B 13/02 (2022.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A43B 13/122*** (2013.01); ***A43B 13/127*** (2013.01); ***A43B 13/145*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ... A43B 13/122; A43B 13/127; A43B 13/145; A43B 13/37; A43B 13/026; A43B 13/04;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,611,152 A 3/1997 Richard
7,114,269 B2 10/2006 Meschan
(Continued)

FOREIGN PATENT DOCUMENTS

CN 101611953 U 12/2009
CN 202145942 U 2/2012
(Continued)

OTHER PUBLICATIONS

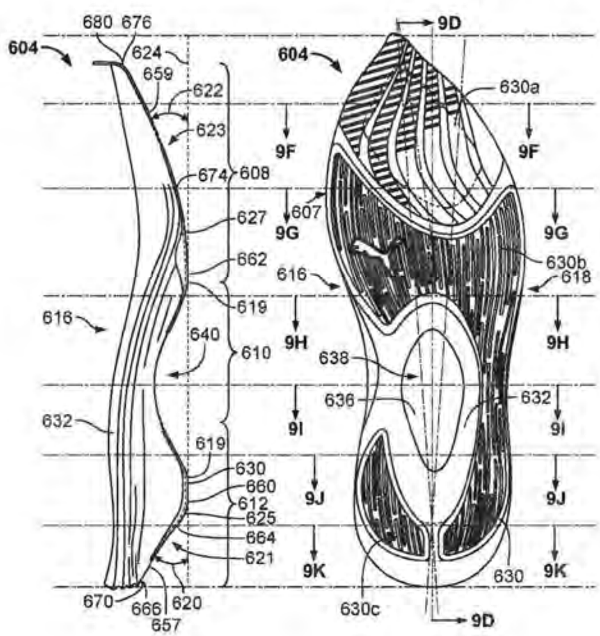
European Search Report from corresponding European Patent Application No. 21 187 302.1 dated Dec. 8, 2021 (9 pages).

Primary Examiner — Bao-Thieu L Nguyen
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

(57) **ABSTRACT**

A sole structure for an article of footwear having an upper includes an outsole having a ground engaging surface and a midsole member disposed between the outsole and the upper. The midsole member has a pocket extending from a heel region to a forefoot region and a sole plate disposed within the pocket. The sole plate extends from the heel region into the forefoot region. In the heel region, the sole structure is shaped to define an entry region that is configured to increase contact at the ground engaging surface during a heel strike. The entry region defines an angled portion that is angled at an entry angle relative to a flat ground surface. The midsole member is a supercritical foam.

25 Claims, 28 Drawing Sheets



Related U.S. Application Data

(60) Provisional application No. 63/195,320, filed on Jun. 1, 2021, provisional application No. 63/055,506, filed on Jul. 23, 2020.

(51) **Int. Cl.**

A43B 13/04	(2006.01)
A43B 13/14	(2006.01)
A43B 13/37	(2006.01)

(52) **U.S. Cl.**
CPC *A43B 13/37* (2013.01); *A43B 13/026* (2013.01); *A43B 13/04* (2013.01)

(58) **Field of Classification Search**
CPC ... A43B 13/146; A43B 13/183; A43B 13/185; A43B 13/186; A43B 13/12; A43B 13/181; A43B 13/187
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,296,973	B2	10/2012	Roberti	
8,307,569	B2	11/2012	McInnis	
8,387,285	B2	3/2013	Hartveld	
8,568,548	B2	10/2013	Park	
8,969,453	B2	3/2015	Park	
9,210,967	B2	12/2015	Gerber	
9,591,891	B1	3/2017	Baucom	
9,605,191	B2	3/2017	Park	
9,936,765	B2	4/2018	Sato	
9,961,959	B2	5/2018	Gerber	
2002/0017036	A1	2/2002	Berger	
2005/0026775	A1	2/2005	Grigsby	
2008/0244932	A1	10/2008	Nau	
2009/0019730	A1	1/2009	Salminen	
2009/0119951	A1	5/2009	Hartveld	
2010/0307032	A1	12/2010	Geer	
2012/0079740	A1	4/2012	Zhou	
2013/0205619	A1	8/2013	Hartveld	
2016/0081427	A1	3/2016	Iuchi	
2016/0353836	A1	12/2016	Luedecke	
2016/0353838	A1	12/2016	Takeshita	
2017/0095033	A1	4/2017	Farina	
2018/0132564	A1 *	5/2018	Bruce	A43B 13/189
2018/0153254	A1	6/2018	Fusco	
2018/0263335	A1	9/2018	Iuchi	
2019/0150554	A1	5/2019	Strickland	
2019/0150562	A1	5/2019	Bartel	
2019/0200700	A1	7/2019	Hale	
2019/0373982	A1	12/2019	Dupre	
2019/0387837	A1	12/2019	Luh	
2020/0121021	A1	4/2020	Bartel	
2020/0383421	A1	12/2020	Bidal	
2020/0383422	A1	12/2020	Bidal	
2021/0137213	A1	5/2021	Stockbridge	
2022/0053886	A1	2/2022	Bramani	

FOREIGN PATENT DOCUMENTS

CN	109222324	A	1/2019
CN	209391167	U	9/2019
CN	212165086	U	12/2020
CN	212787628	U	3/2021
DE	112006002347	T5	7/2008
DE	102016118168	A1	11/2017
DE	112006002347	B4	7/2019
EP	3574787	A1	12/2019
GB	2288550	B	2/1998
GB	2425455	A	11/2006
GB	2431334	A	4/2007
GB	2431333	B	10/2010
GB	2437698	B	10/2010
GB	2499416	A	8/2013
JP	2509505	B2	6/1996
JP	6307728	B1	4/2018
JP	2021030079	A	3/2021
WO	2007026175	A1	3/2007
WO	2016132927	A1	8/2016
WO	2018137649	A1	8/2018
WO	2019204358	A1	10/2019

* cited by examiner

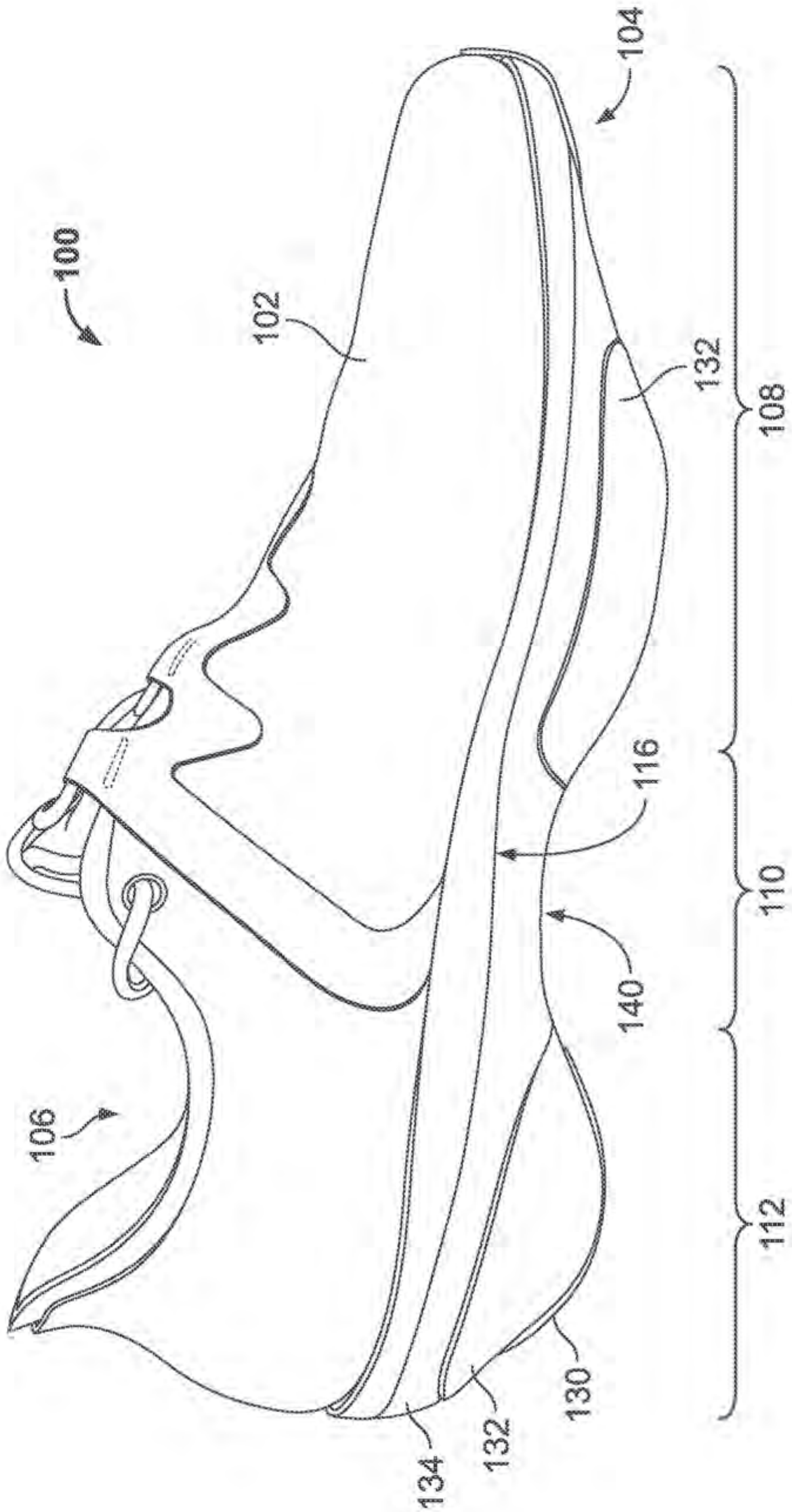


FIG. 1

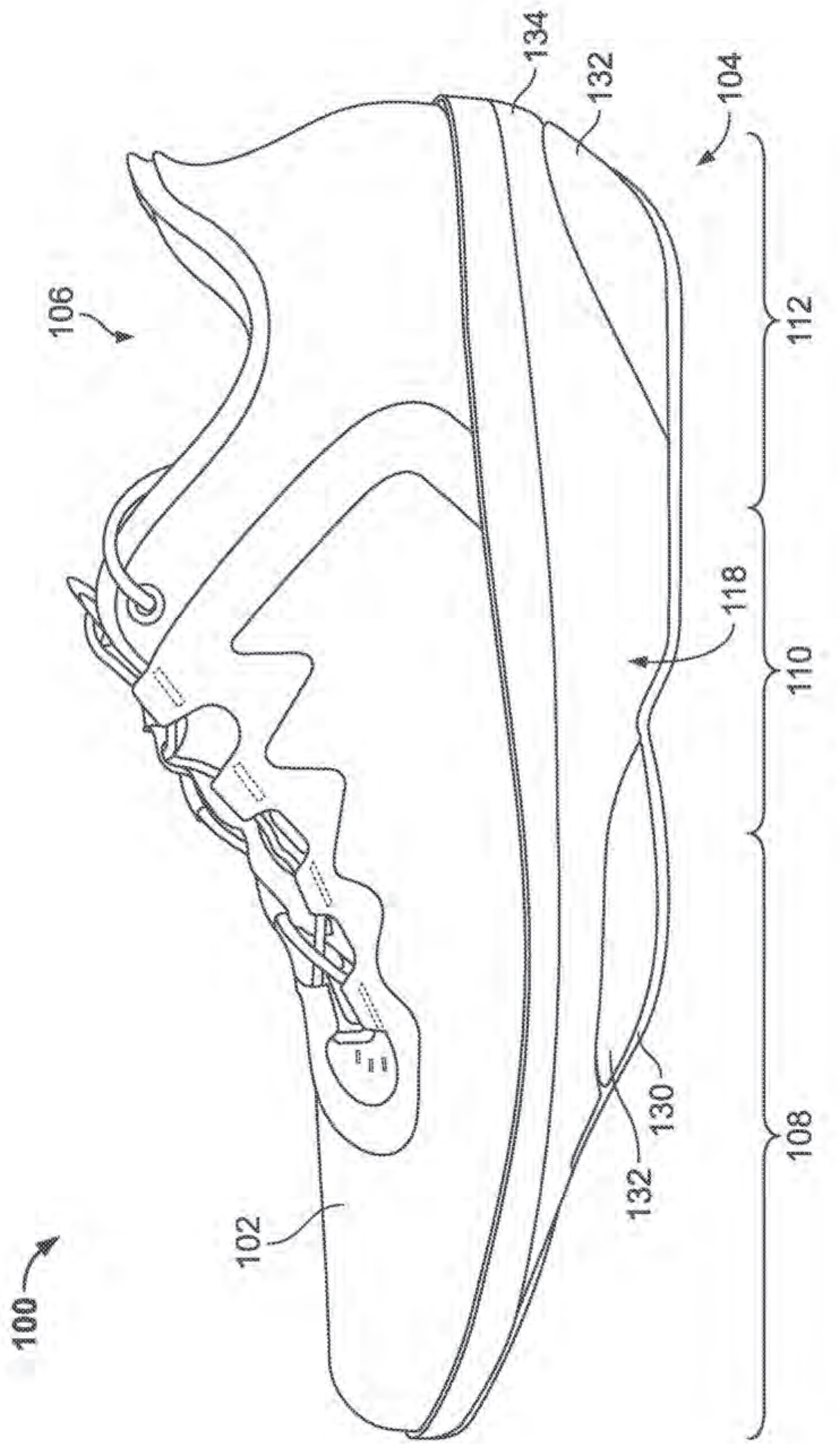


FIG. 2

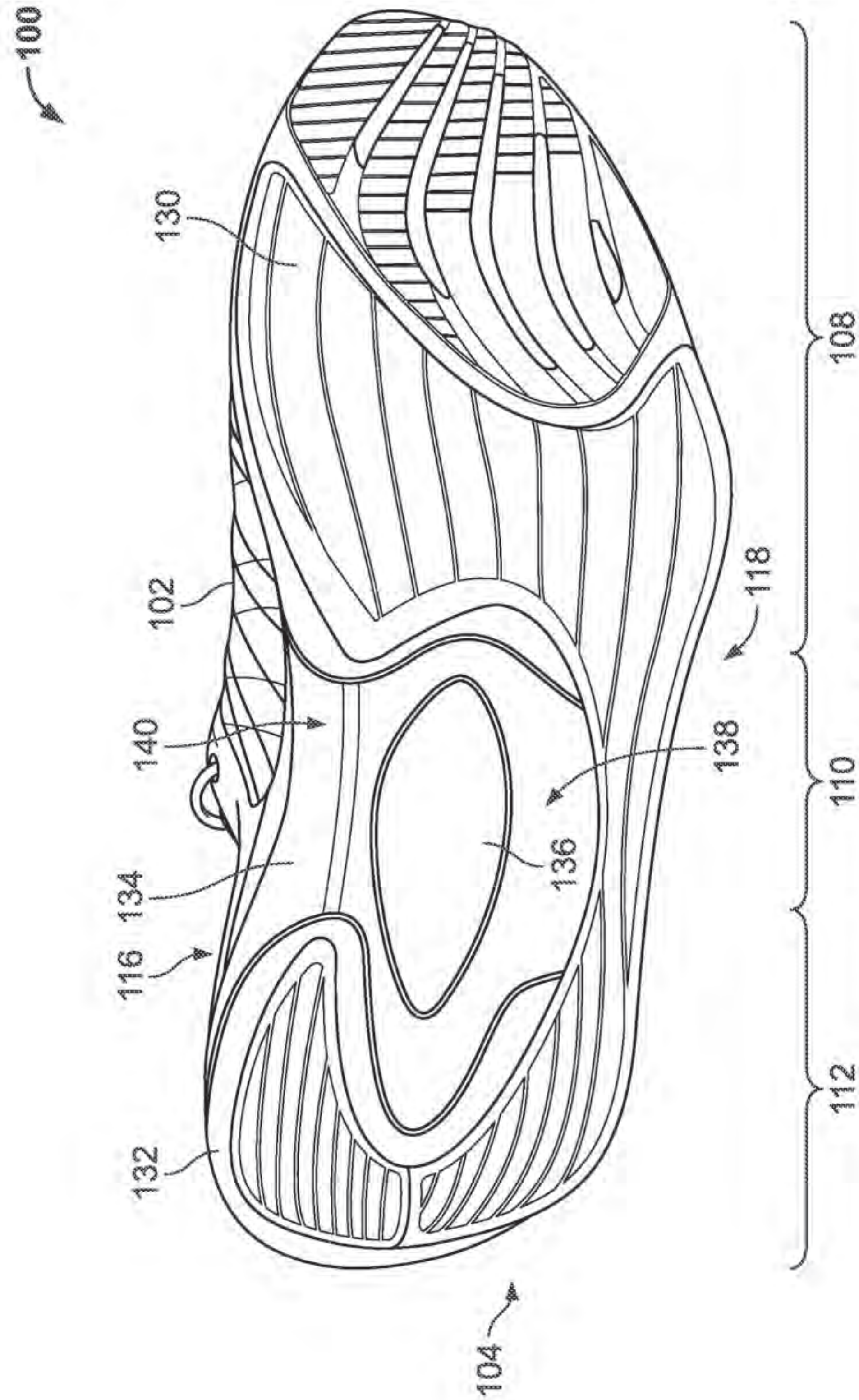


FIG. 3

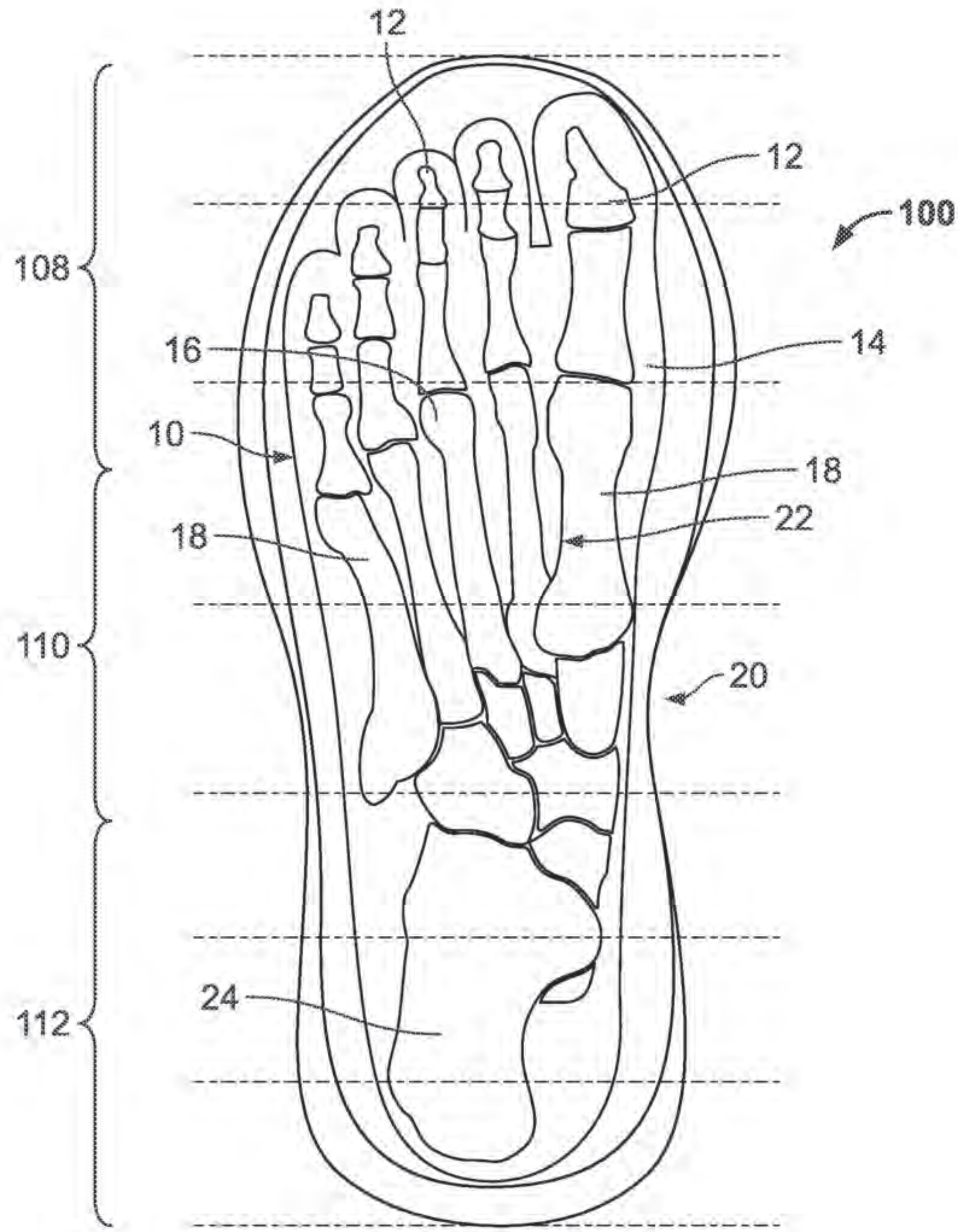


FIG. 4

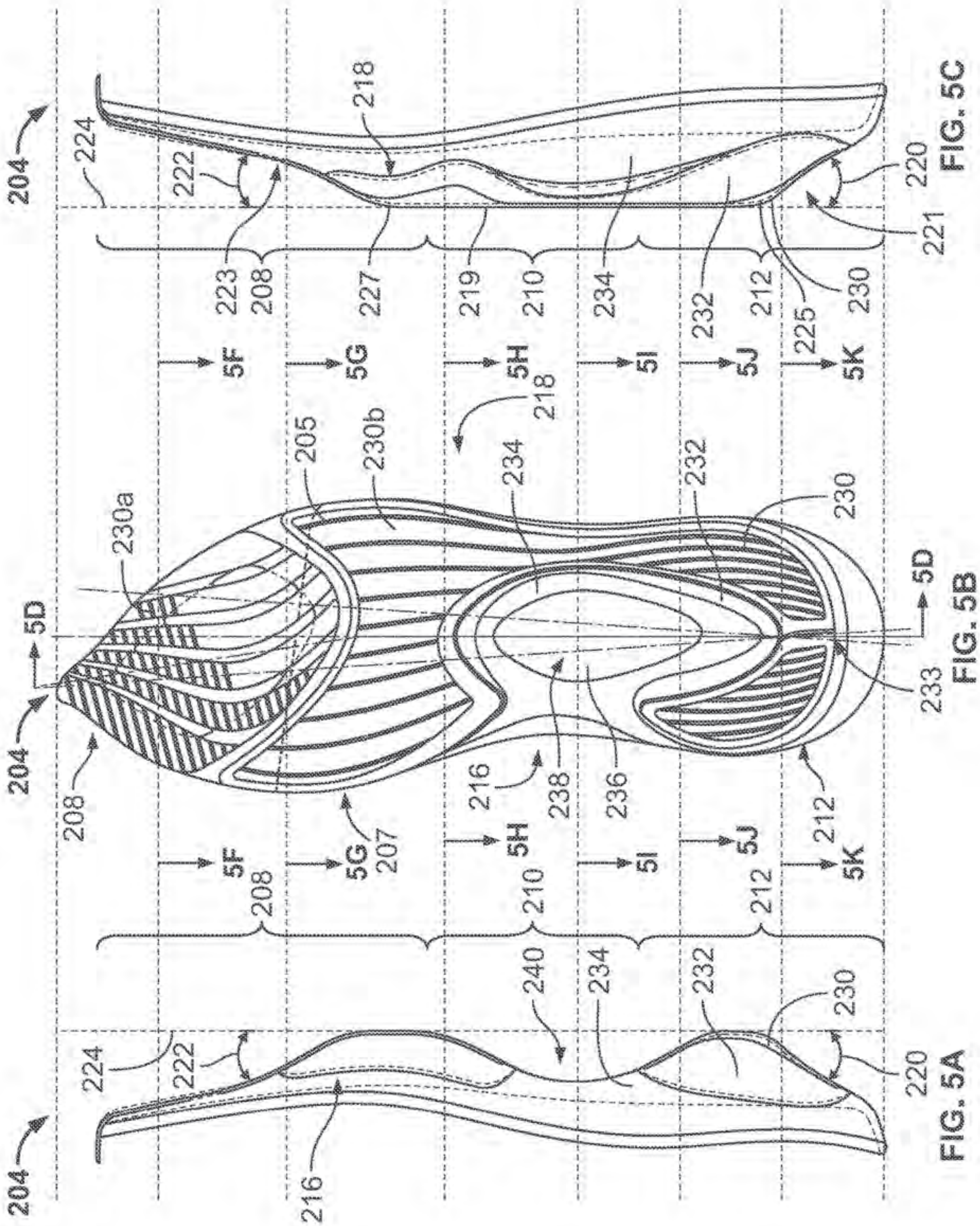


FIG. 5A

FIG. 5B

FIG. 5C

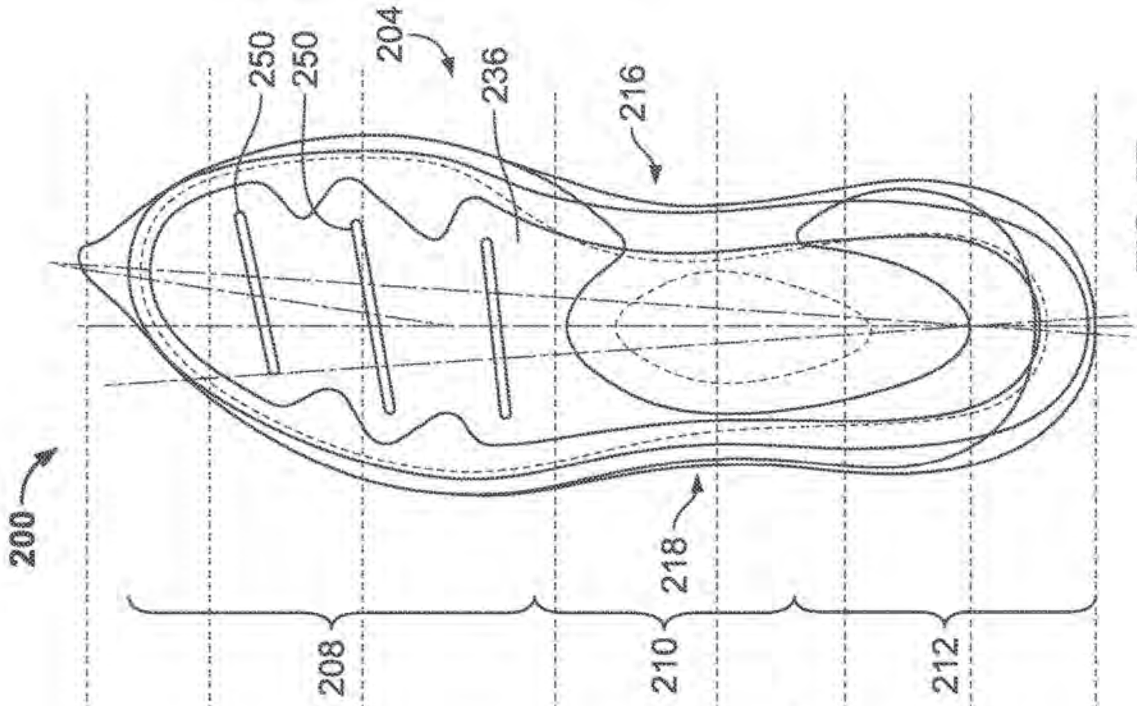

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FIG. 5E

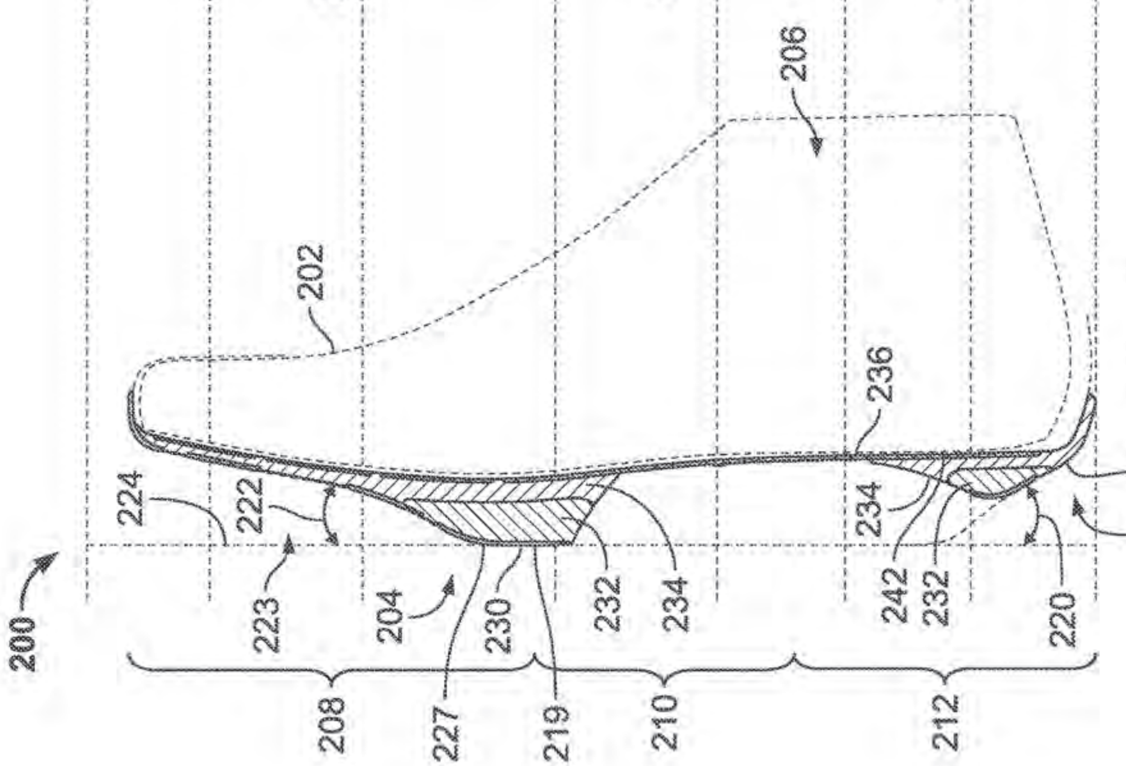
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FIG. 5D

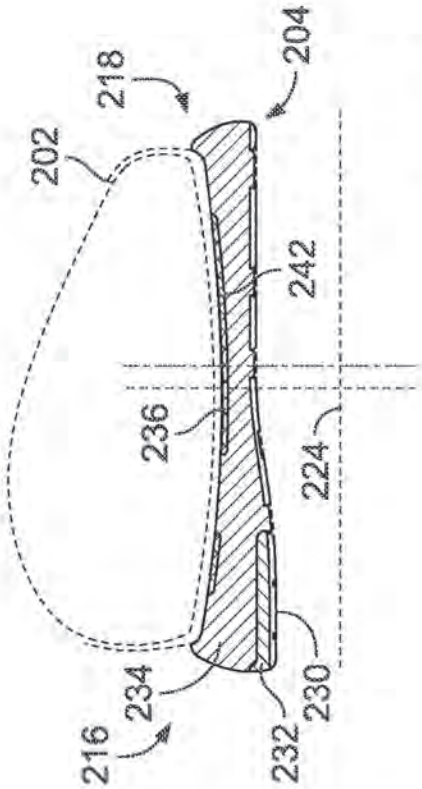

FIG. 5G

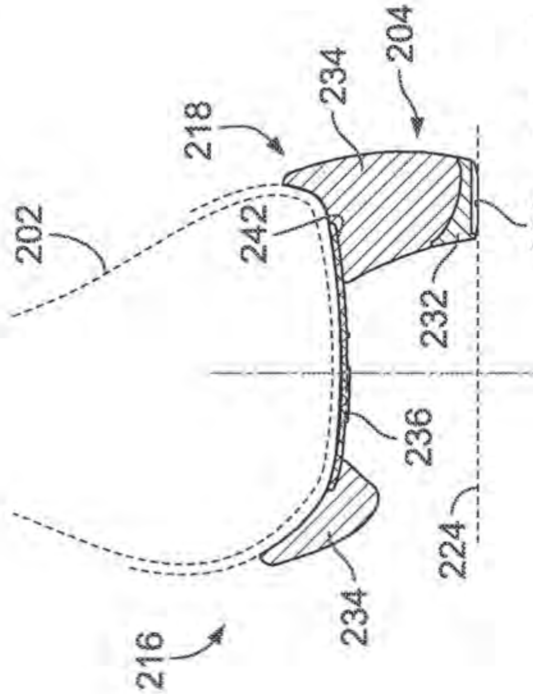

FIG. 5I

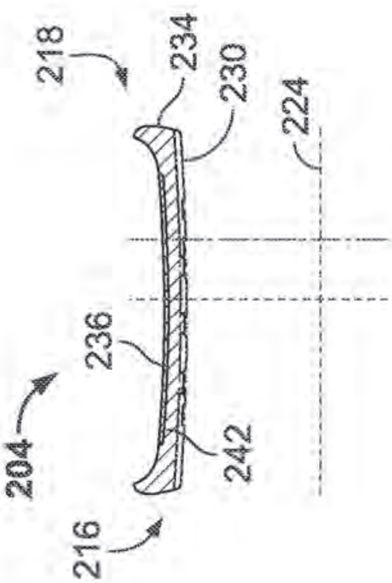

FIG. 5F

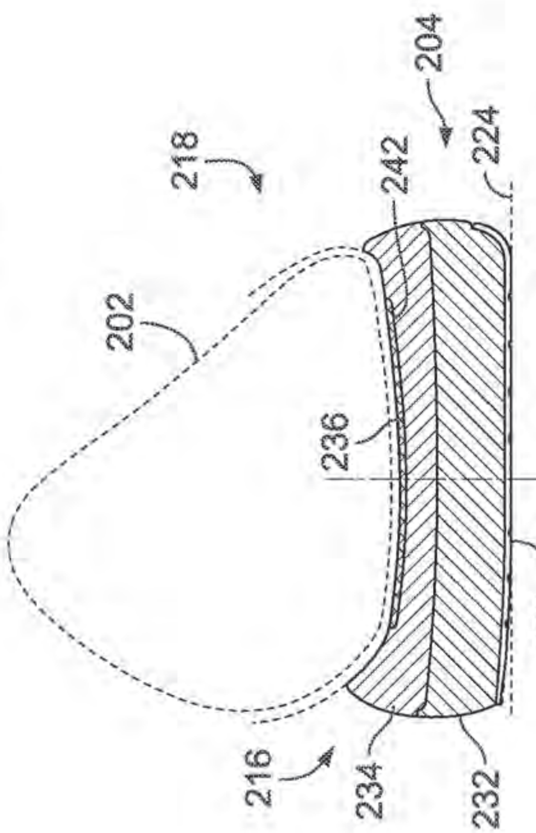

FIG. 5H

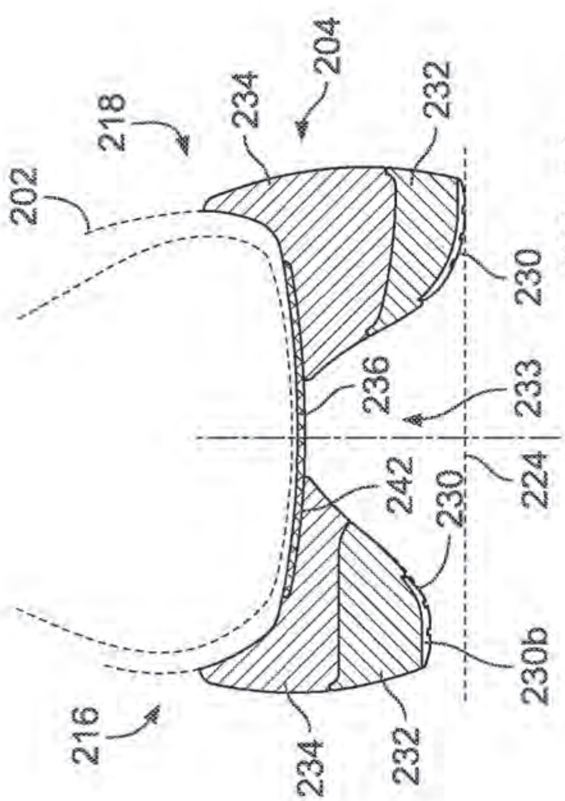

FIG. 5J

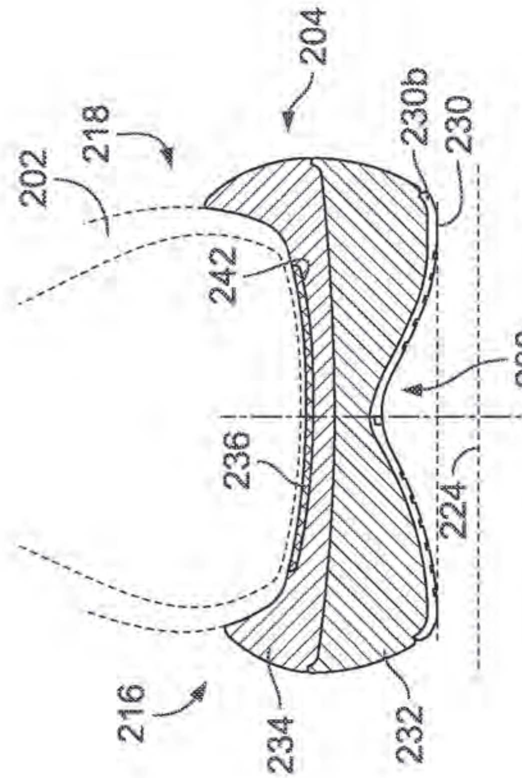

FIG. 5K

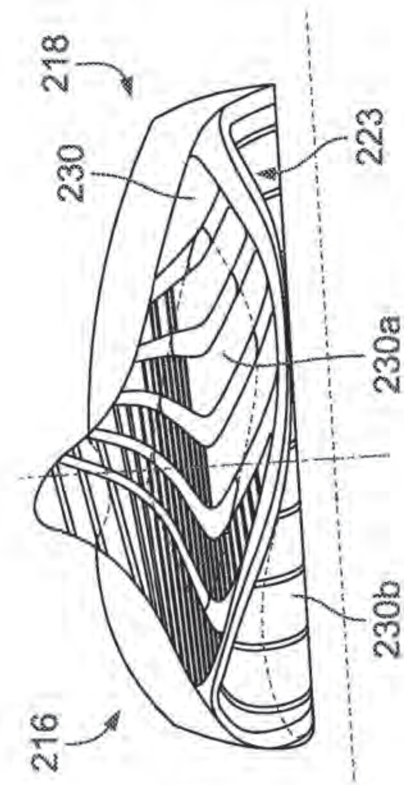

FIG. 5L

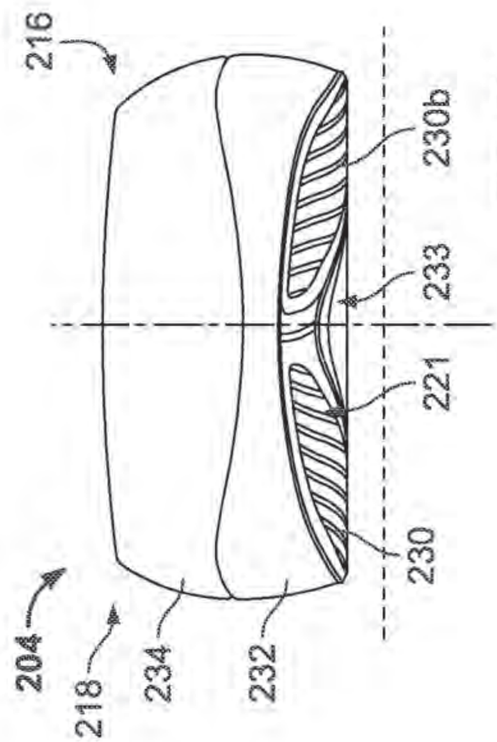

FIG. 5M

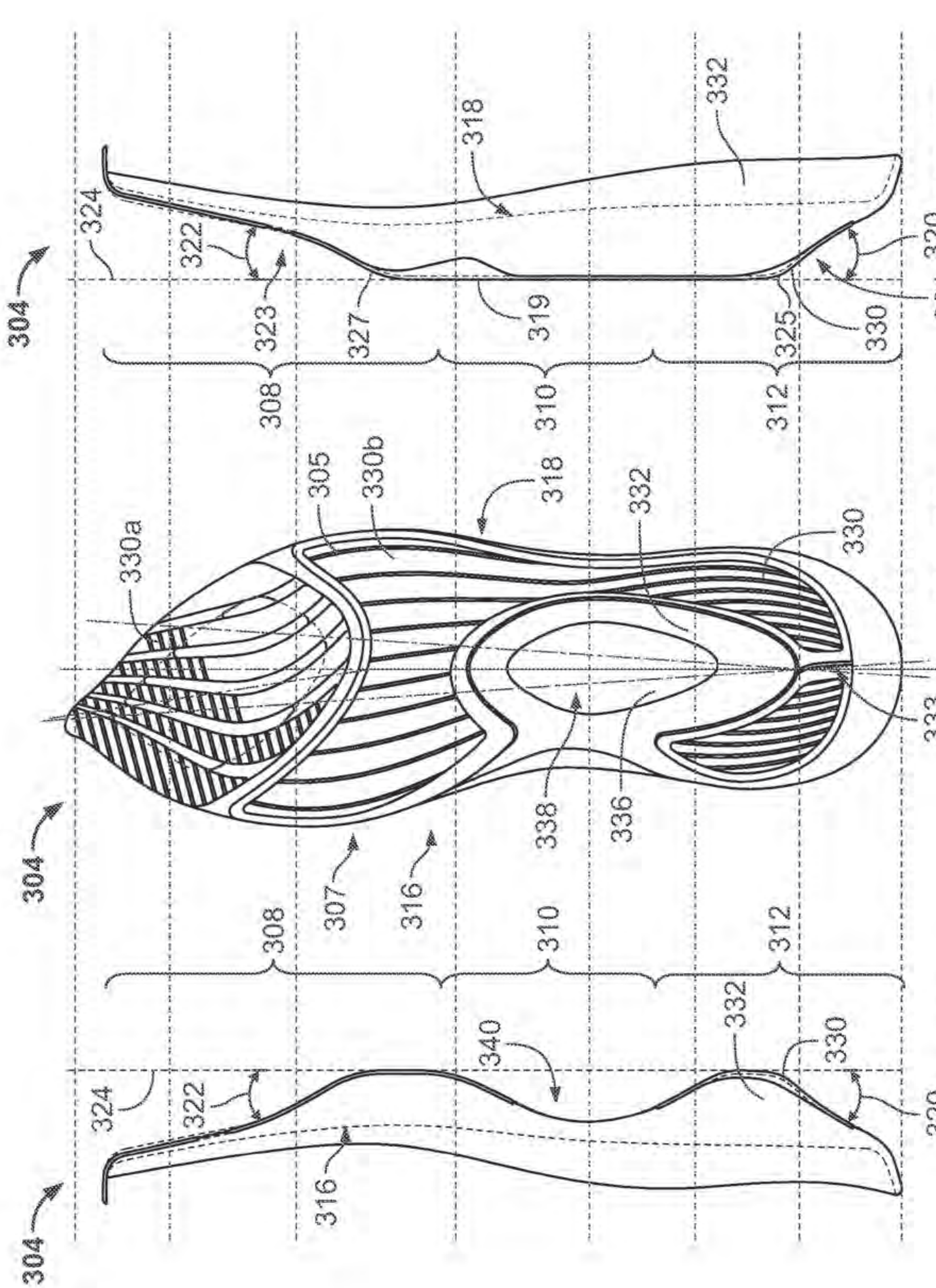

FIG. 6C

FIG. 6B

FIG. 6A

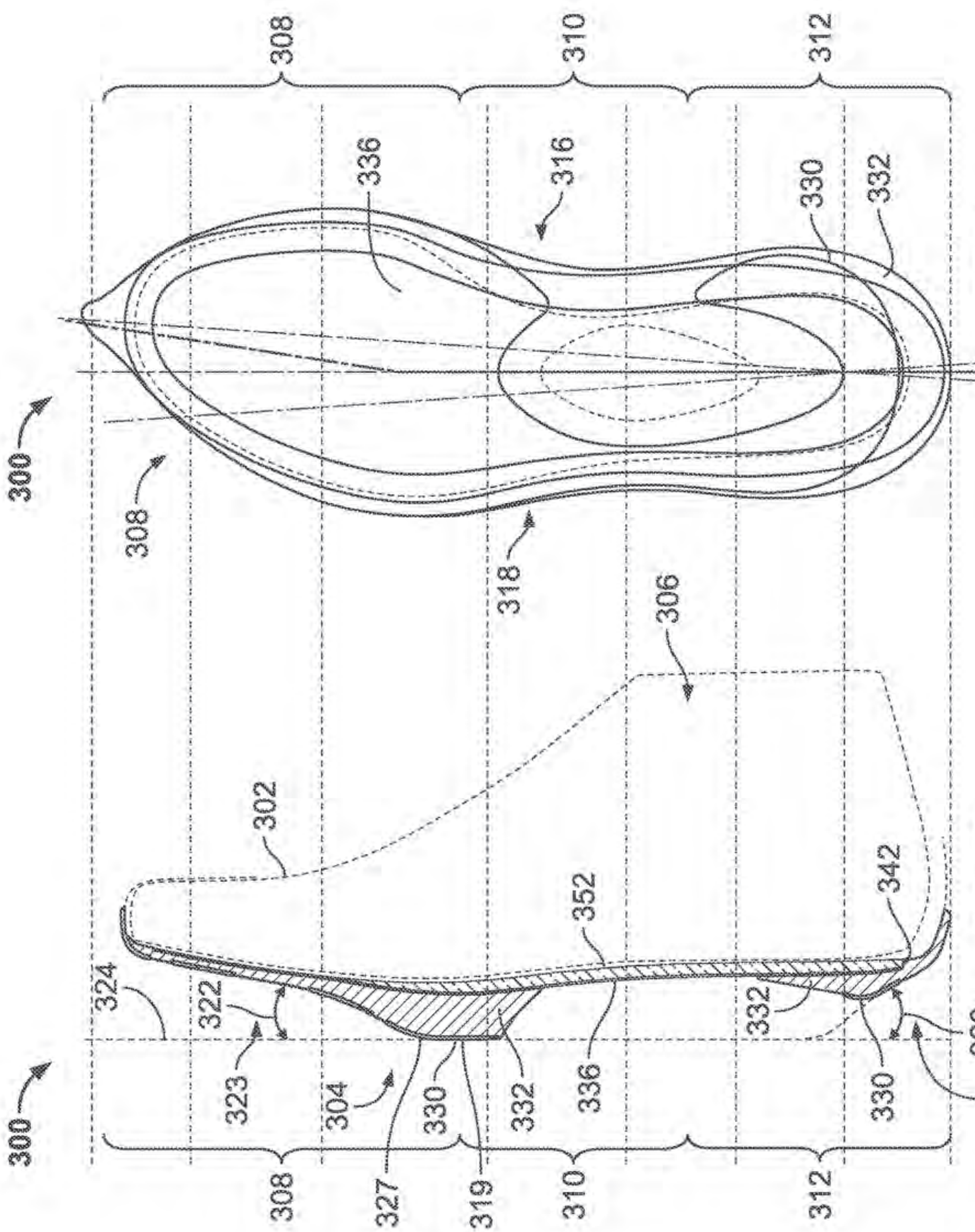

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FIG. 6E

FIG. 6D

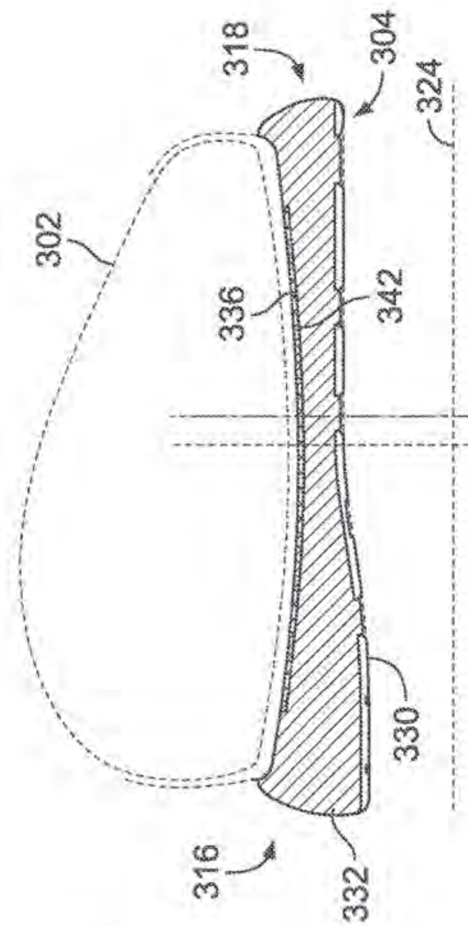

FIG. 6G

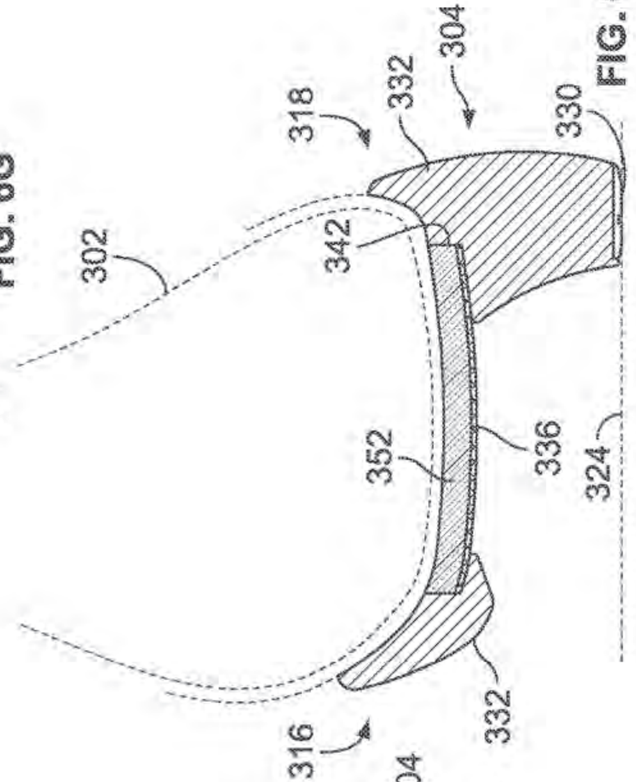

FIG. 6I

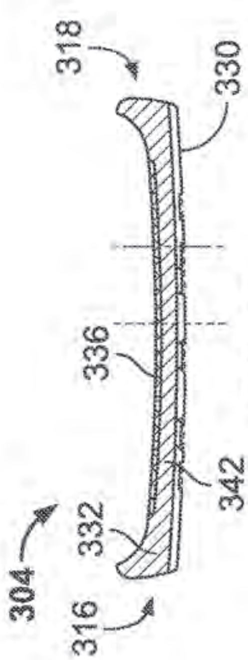

FIG. 6F

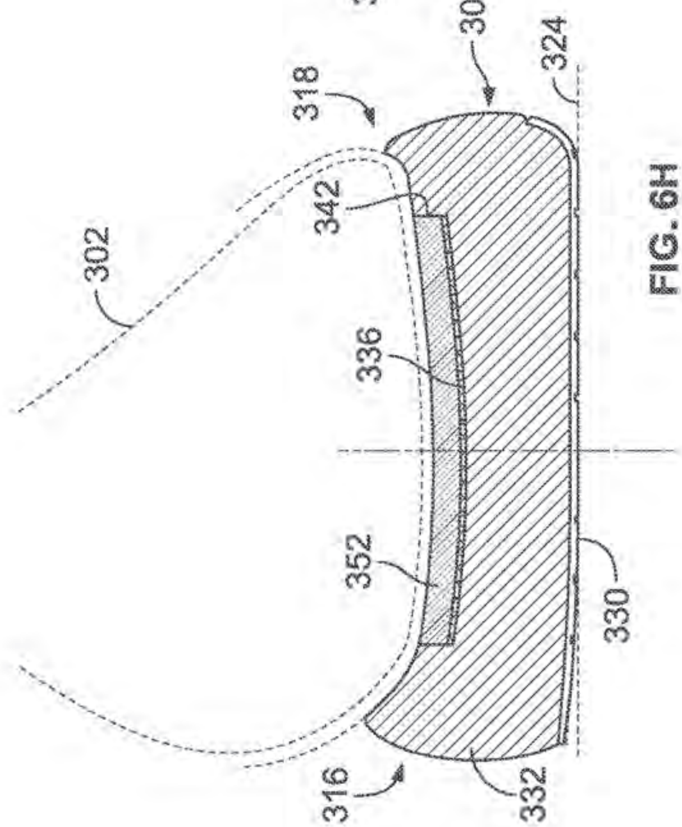

FIG. 6H

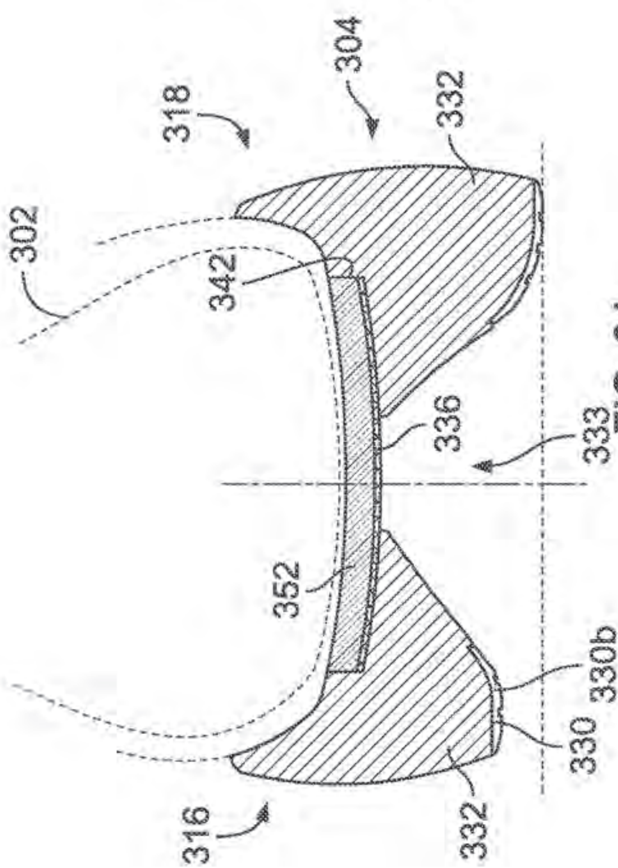

FIG. 6J

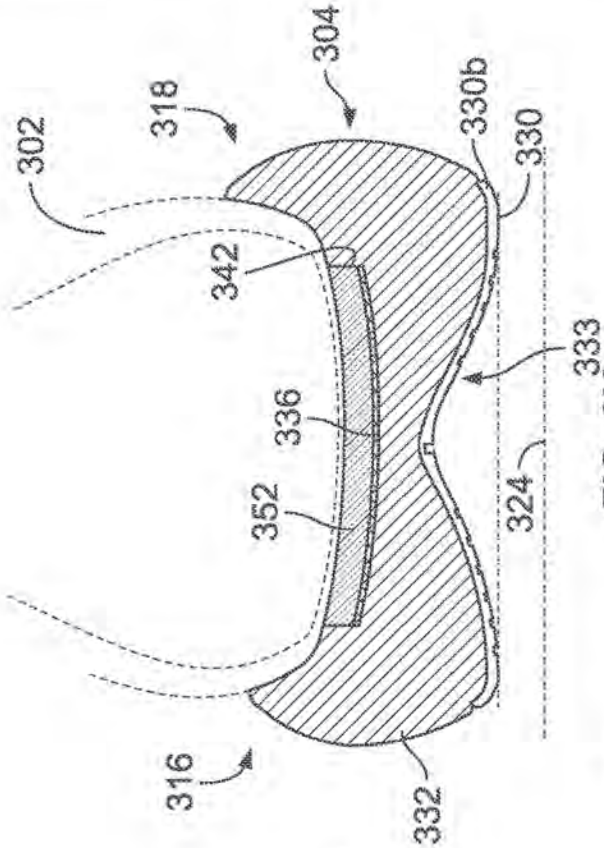

FIG. 6K

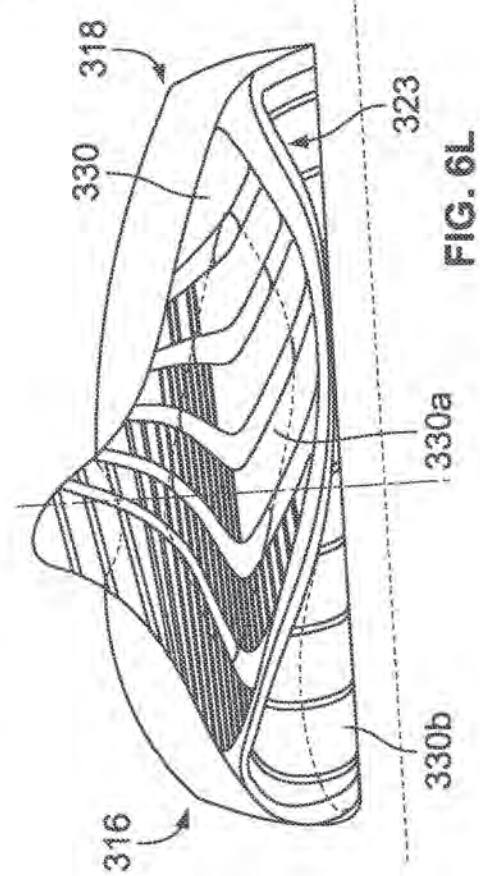

FIG. 6L

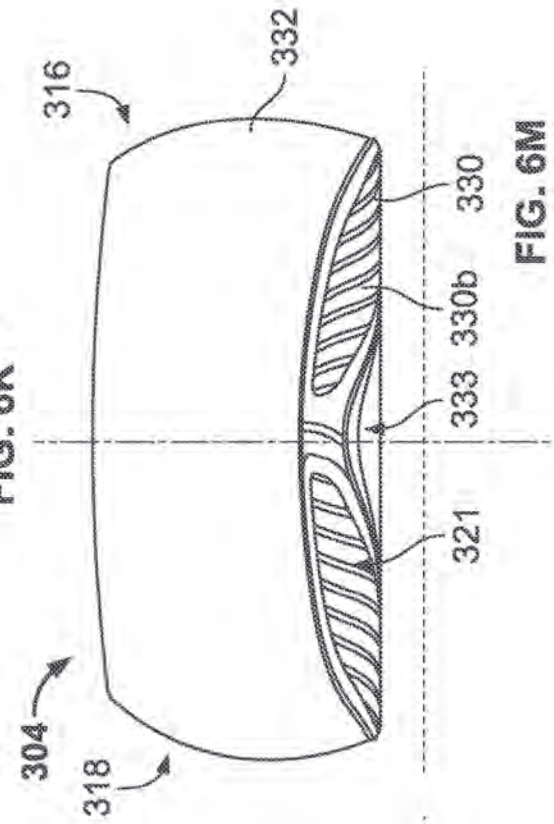

FIG. 6M

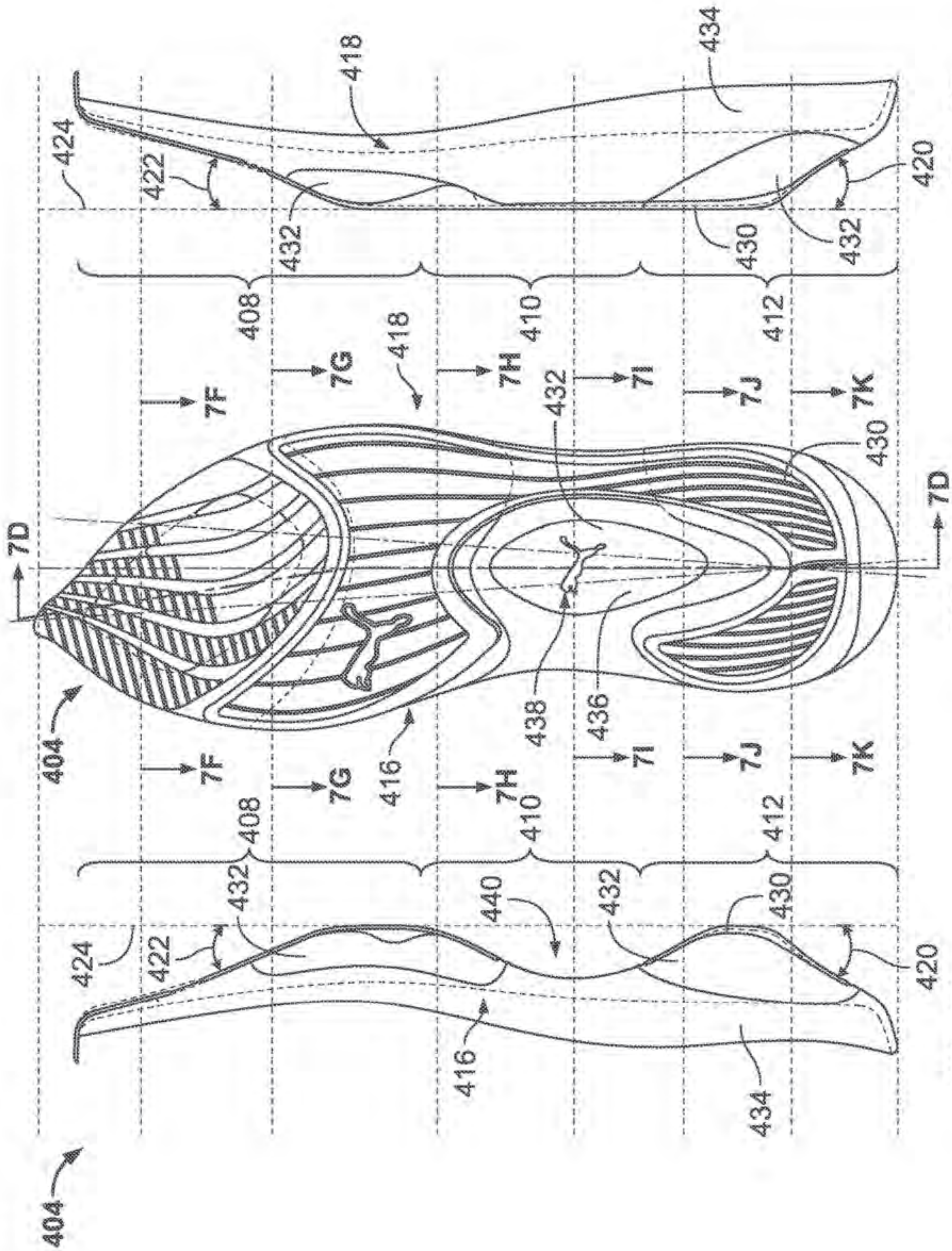

FIG. 7C

FIG. 7B

FIG. 7A

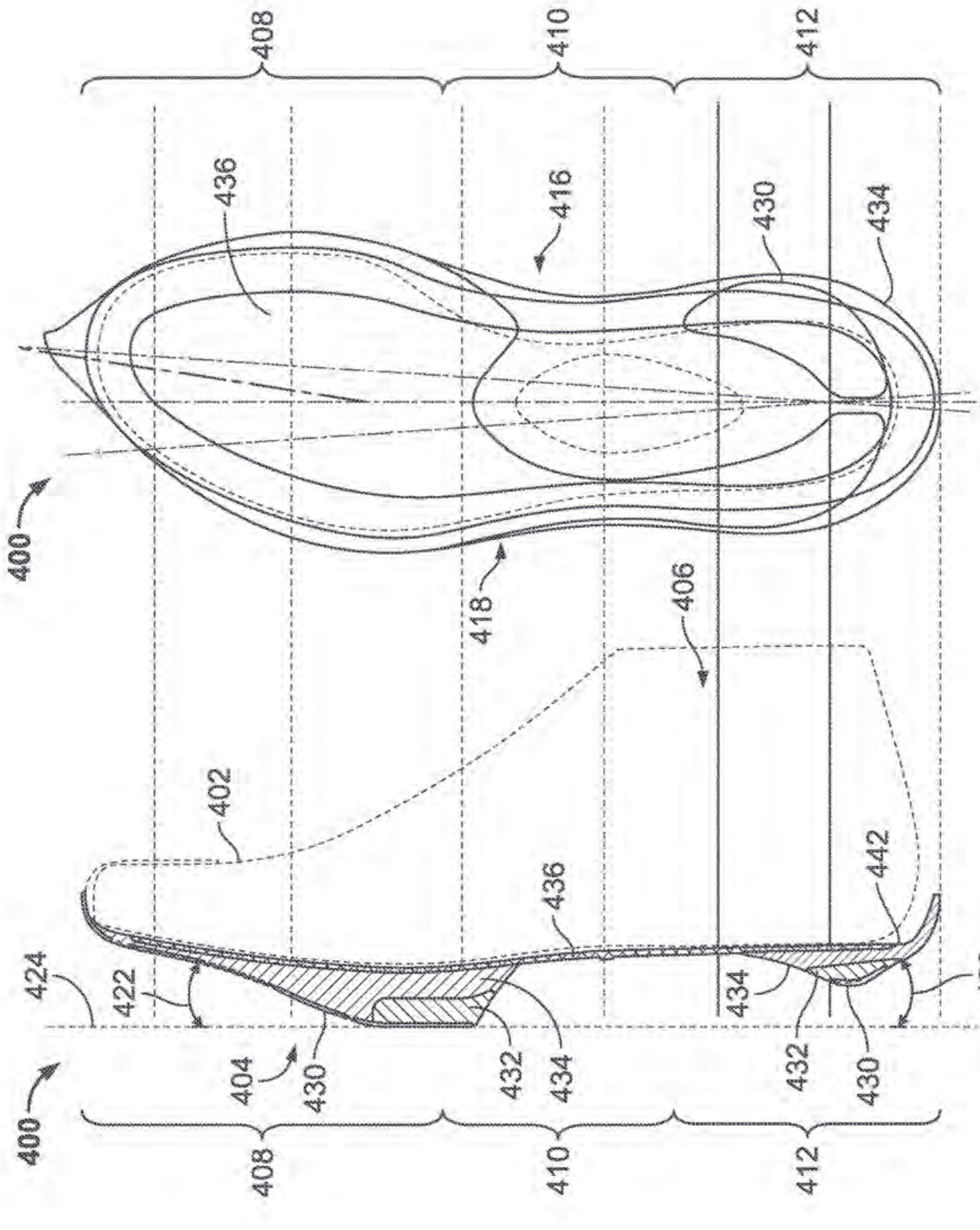
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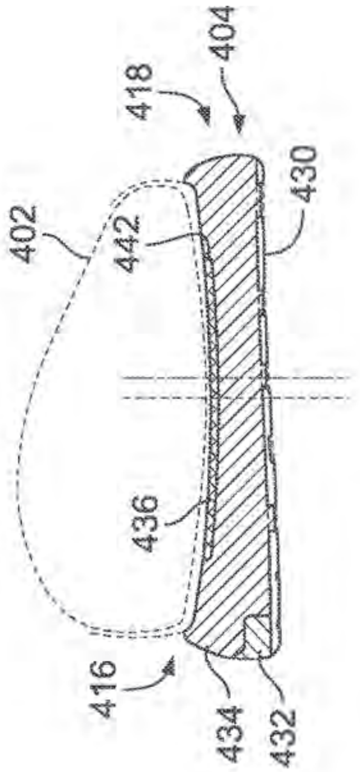
FIG. 7E

FIG. 7D



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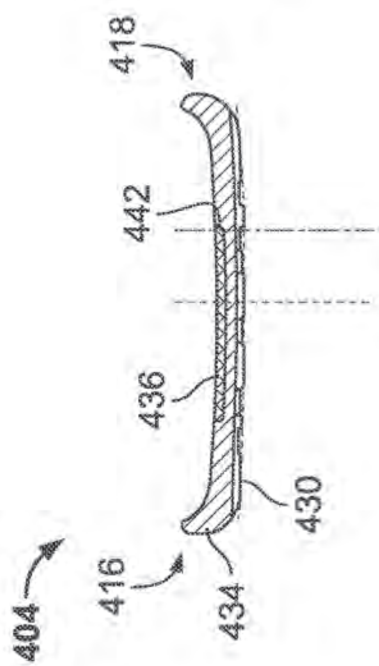

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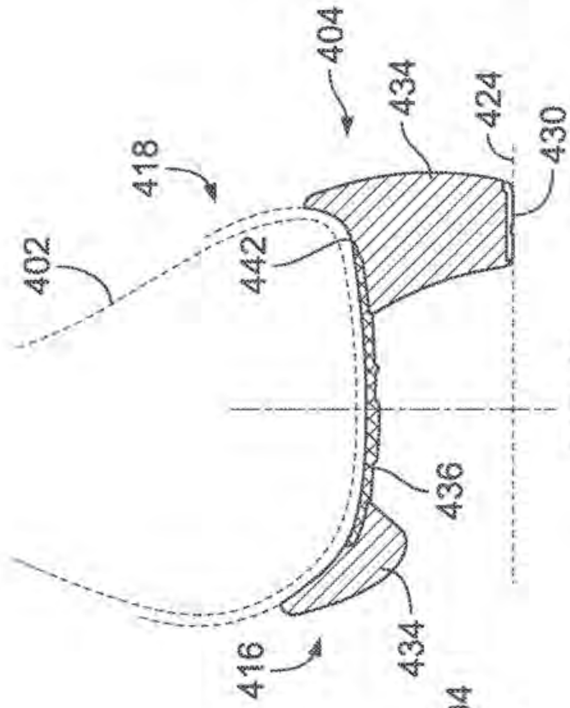

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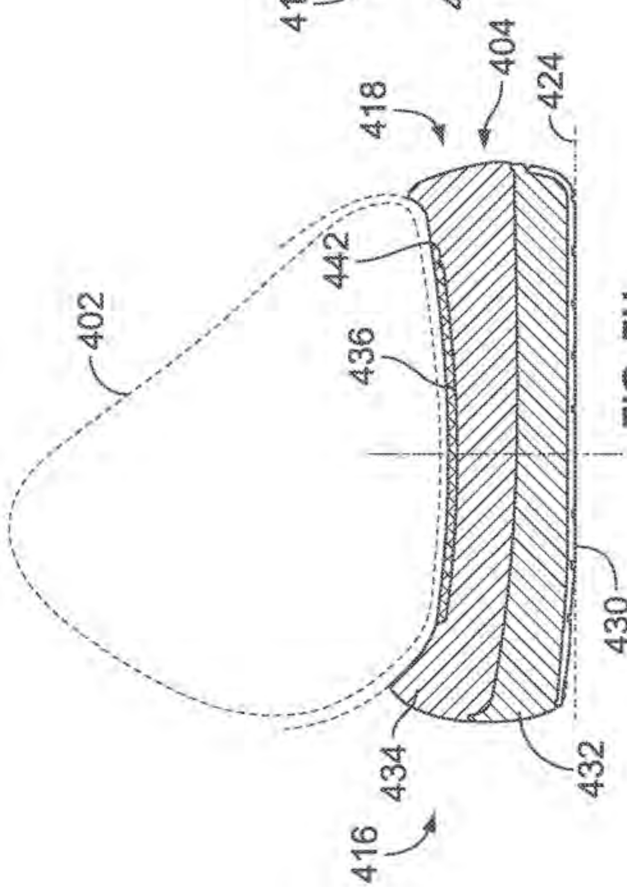

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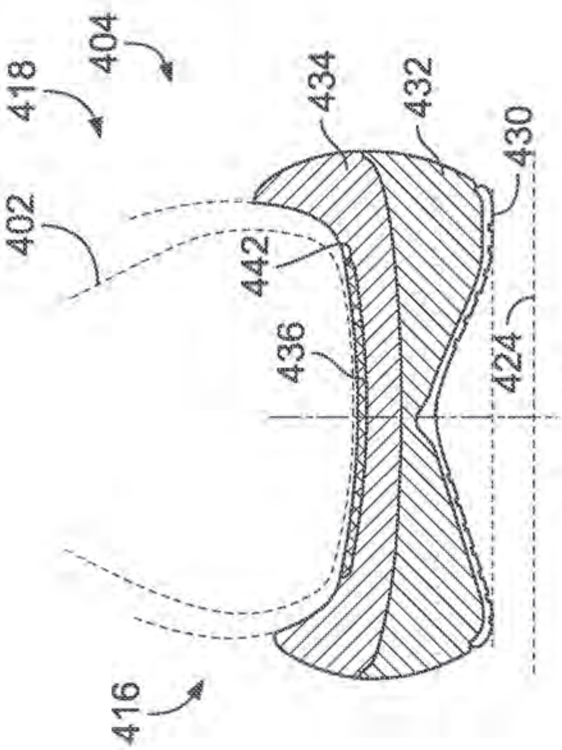


FIG. 7K

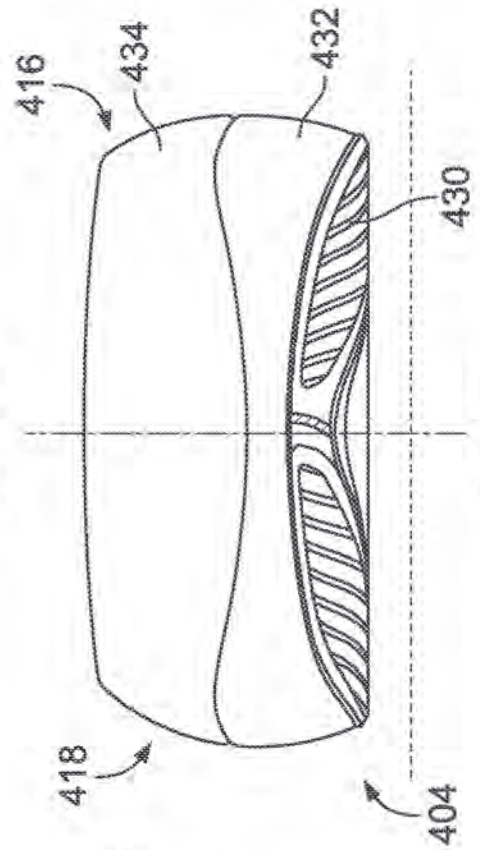


FIG. 7M

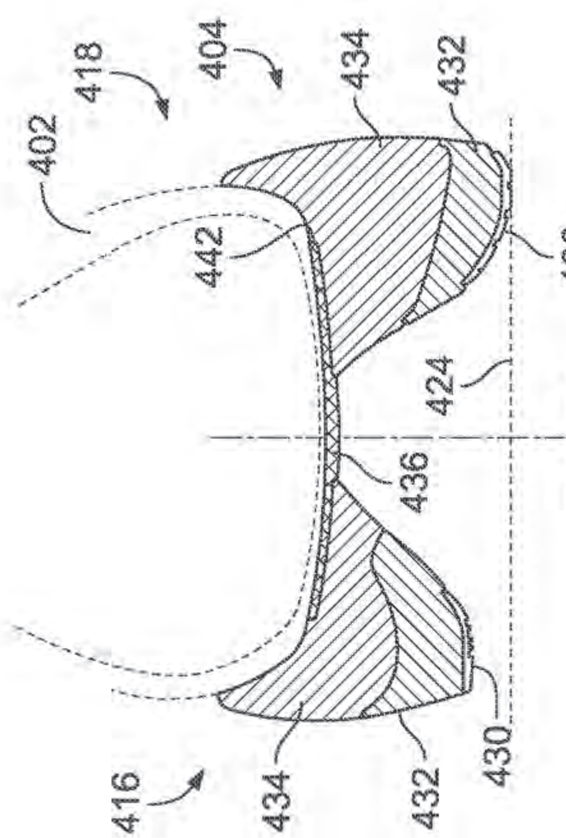
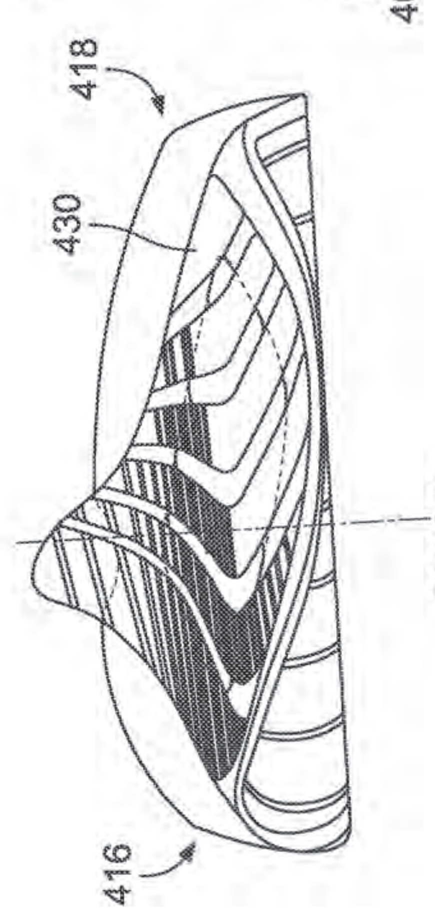


FIG. 7J



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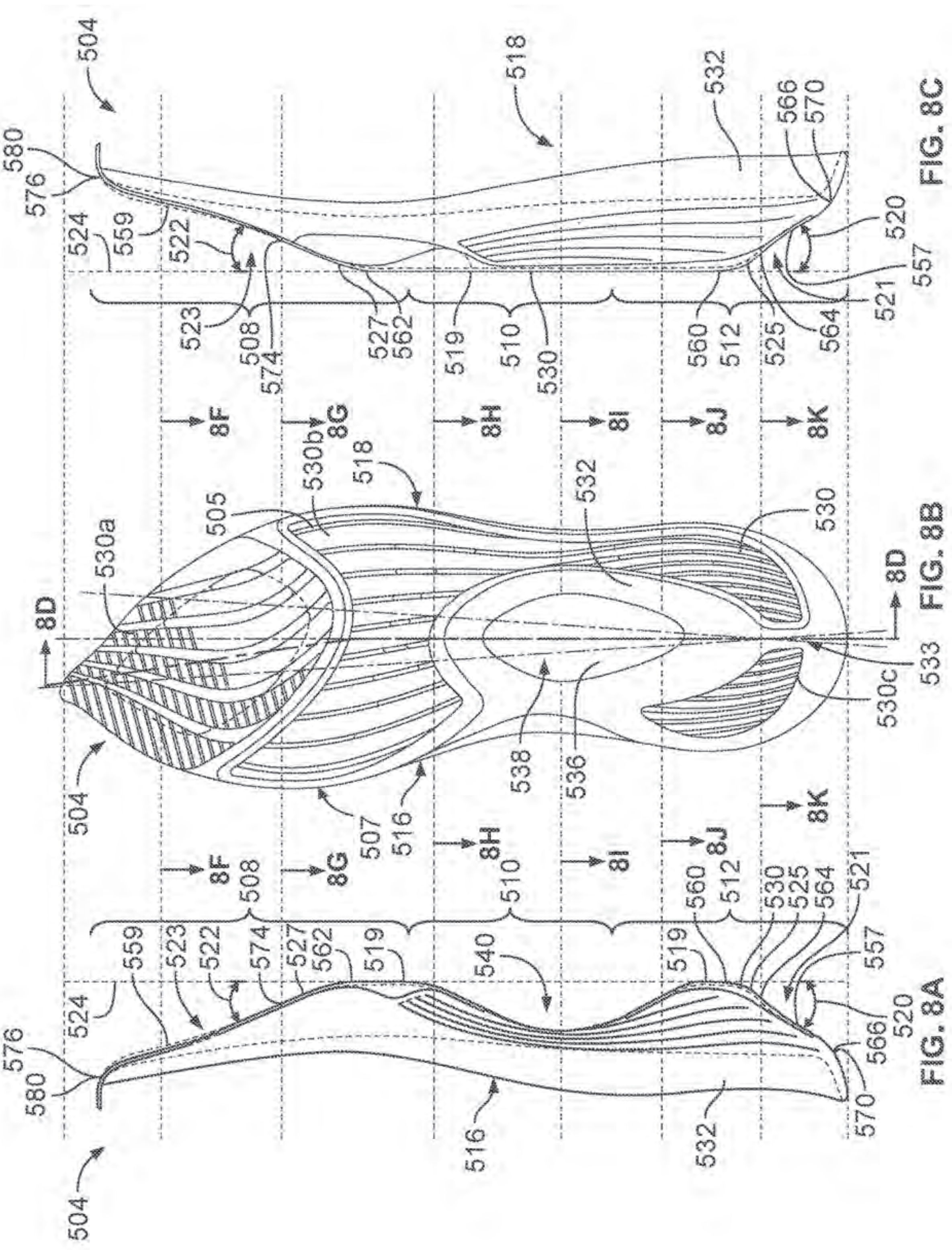

FIG. 8A

FIG. 8B

FIG. 8C

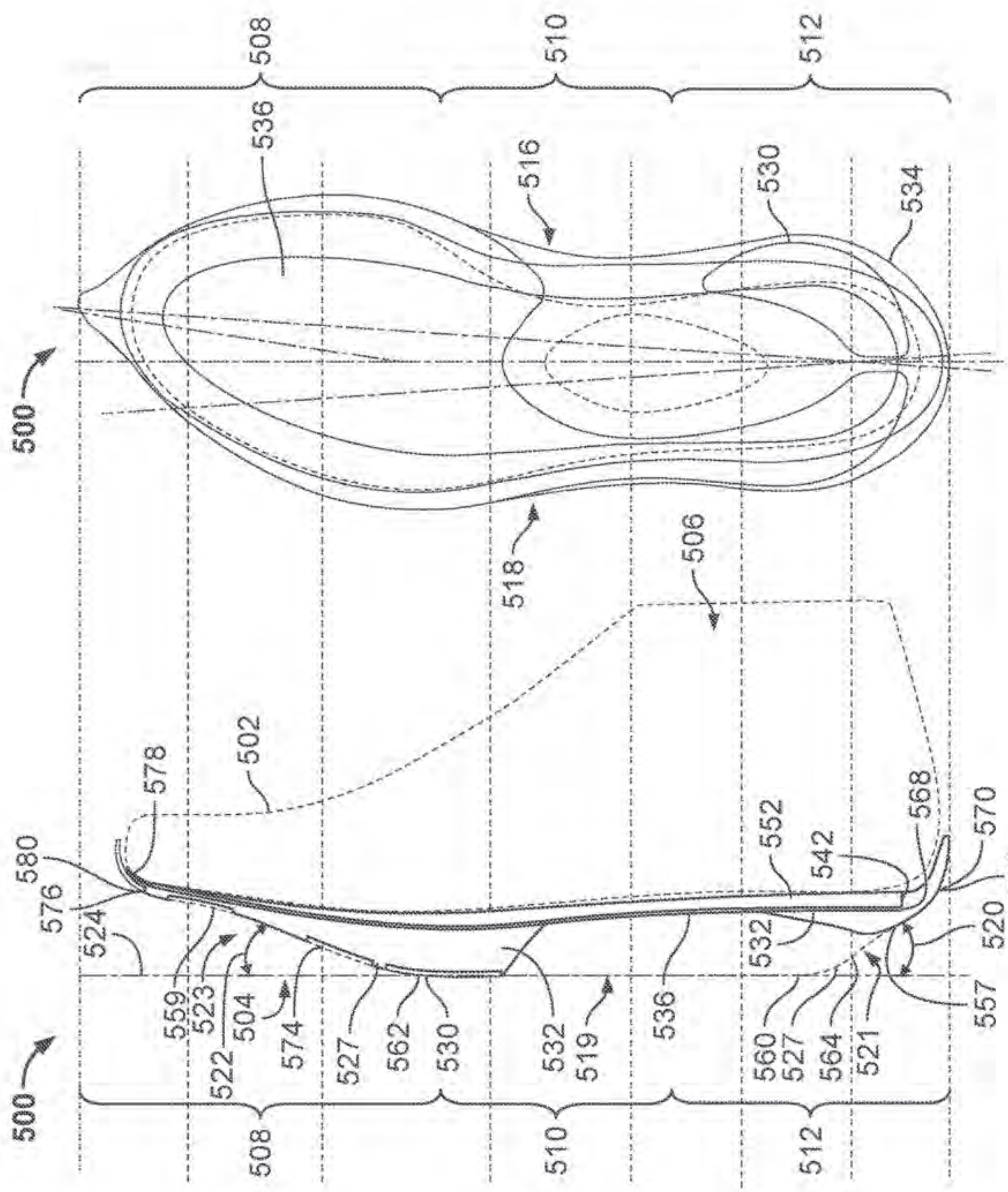
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FIG. 8E

FIG. 8D

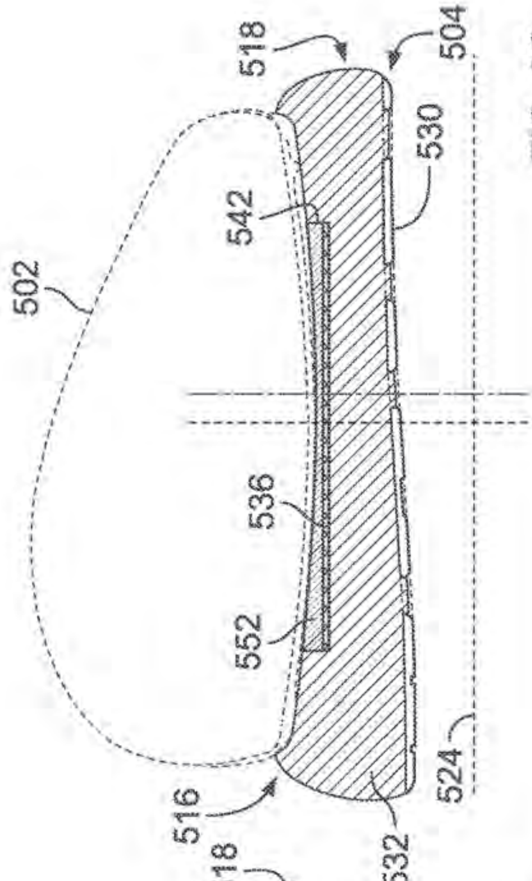
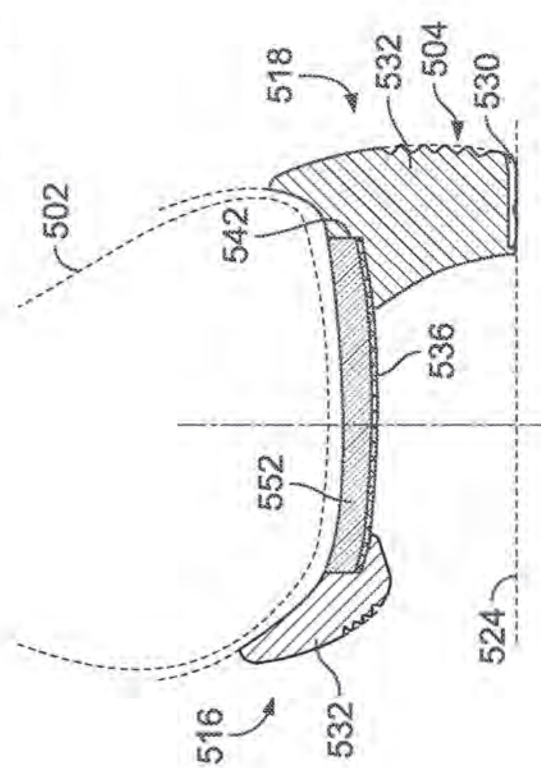


FIG. 8G



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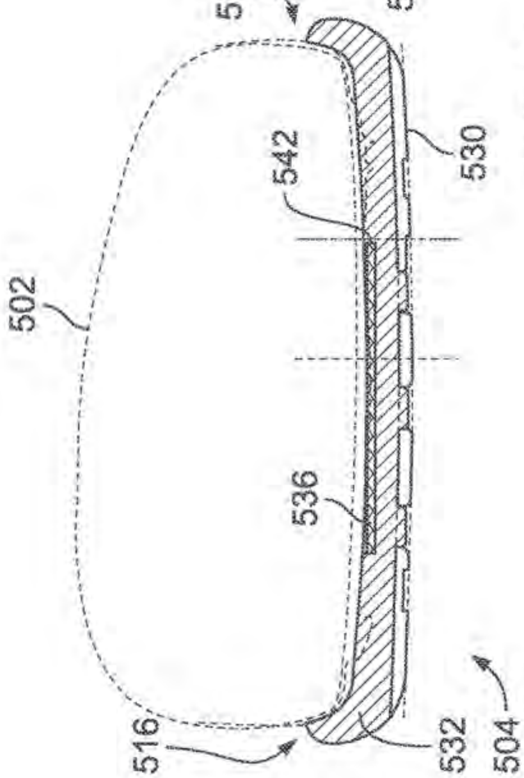

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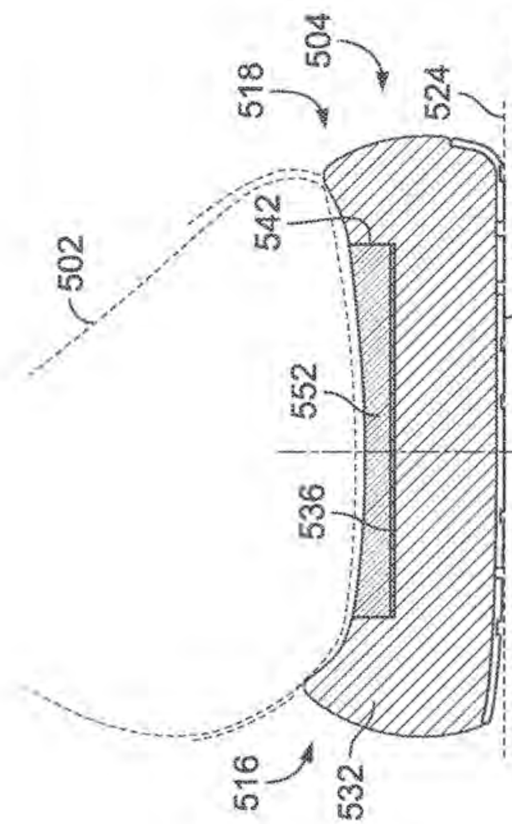

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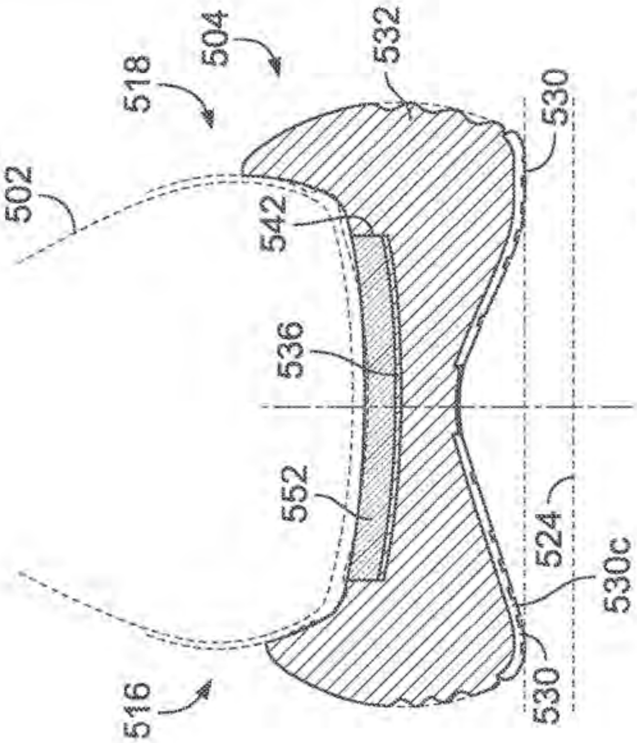

FIG. 8K

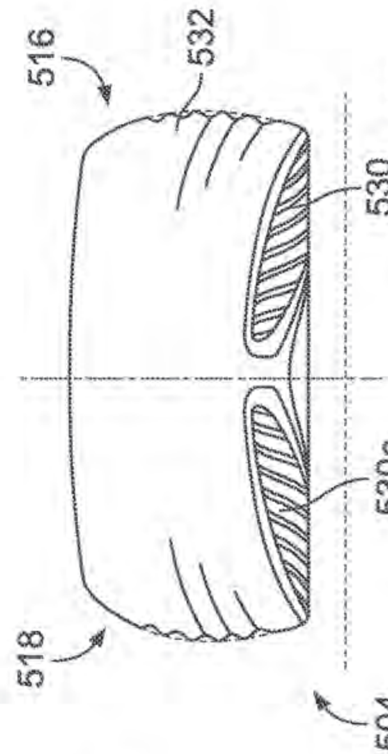

FIG. 8M

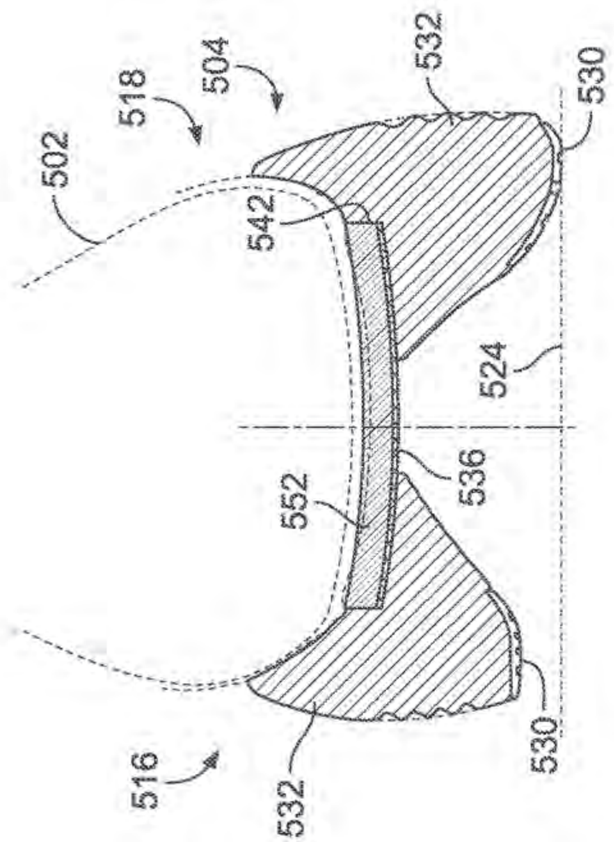

FIG. 8J

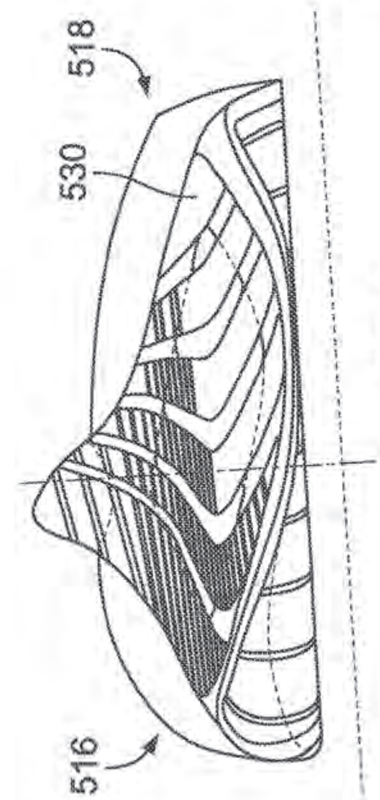

FIG. 8L

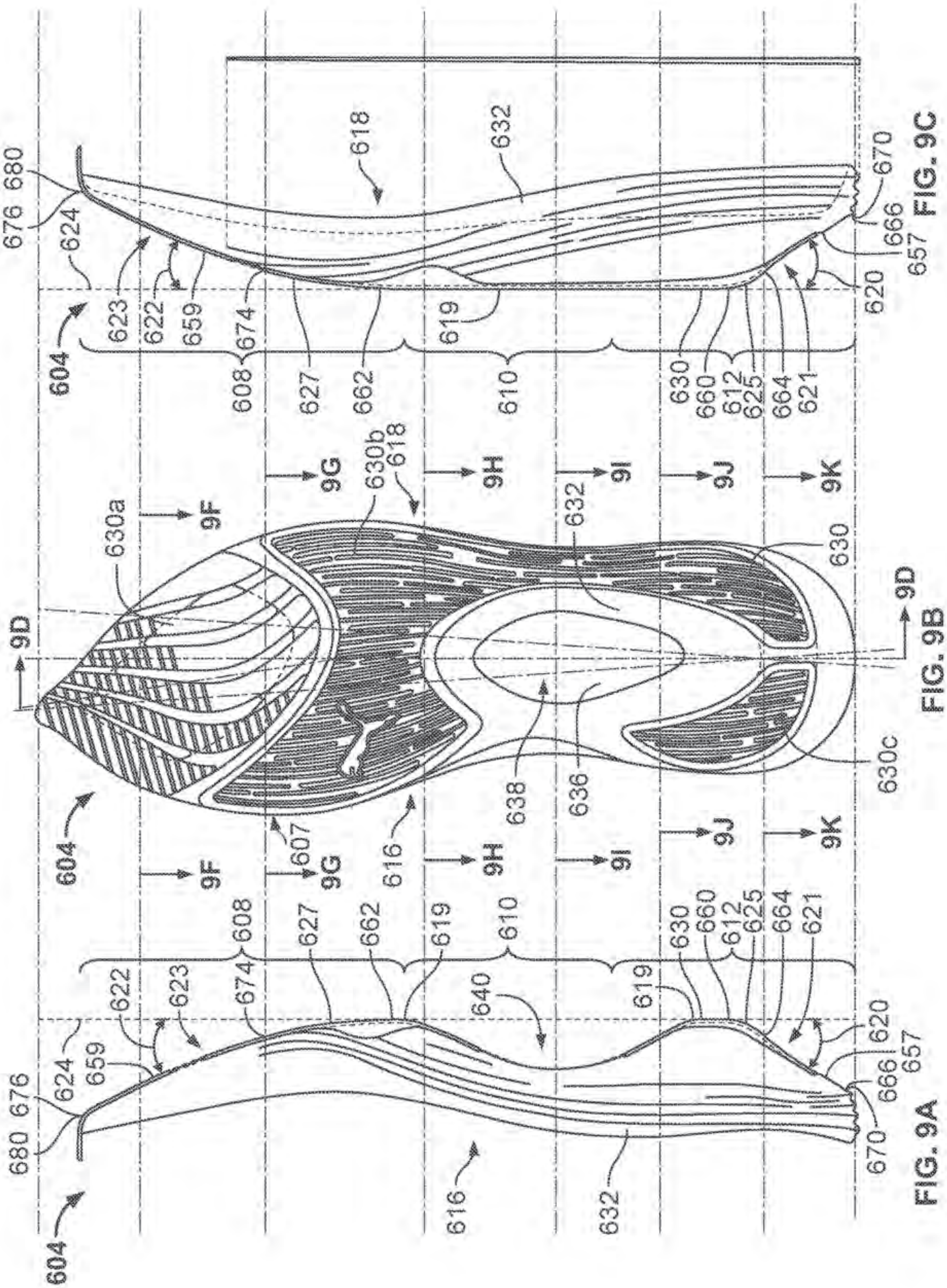

FIG. 9A

FIG. 9B

FIG. 9C

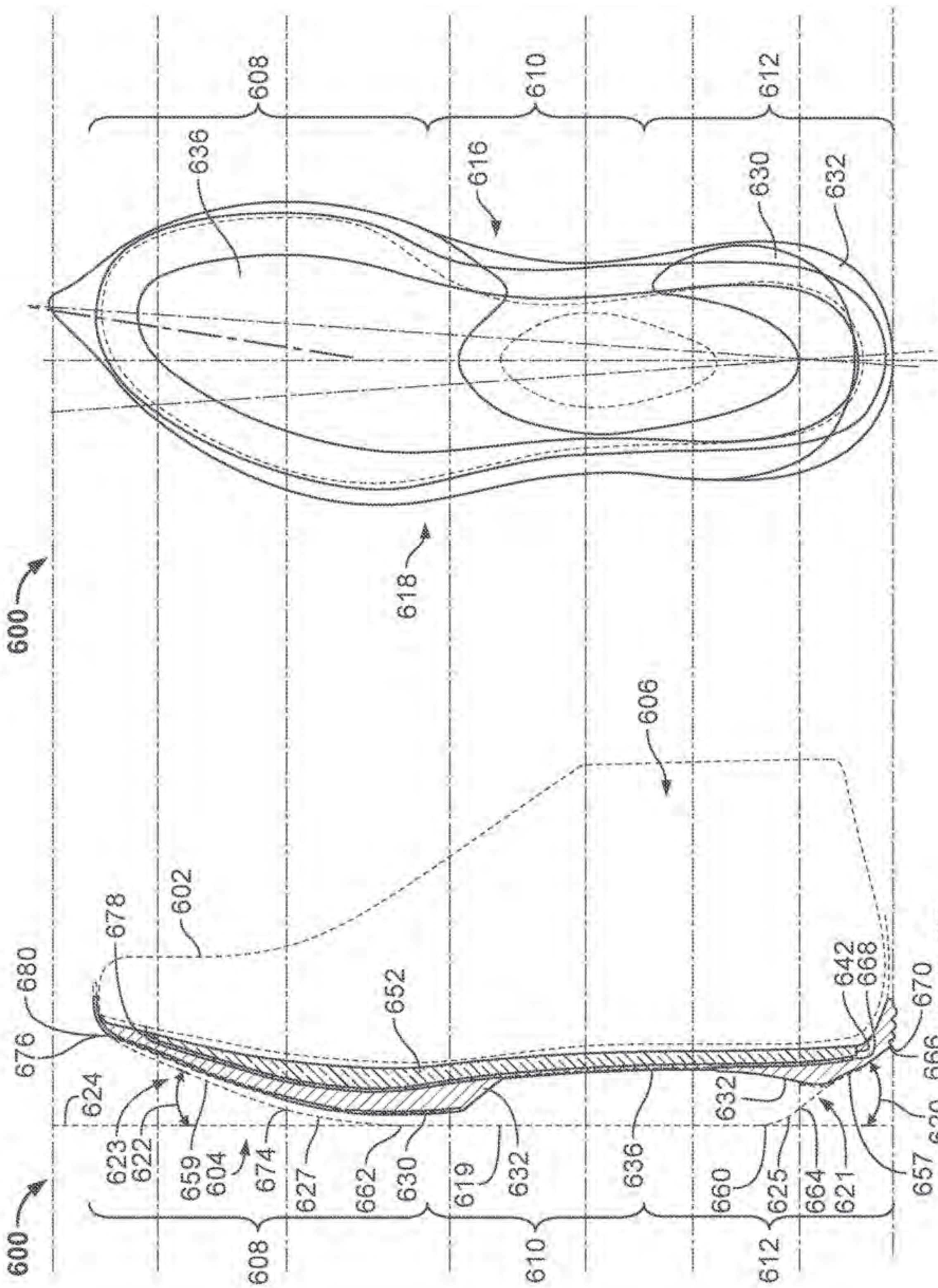

FIG. 9D

FIG. 9E

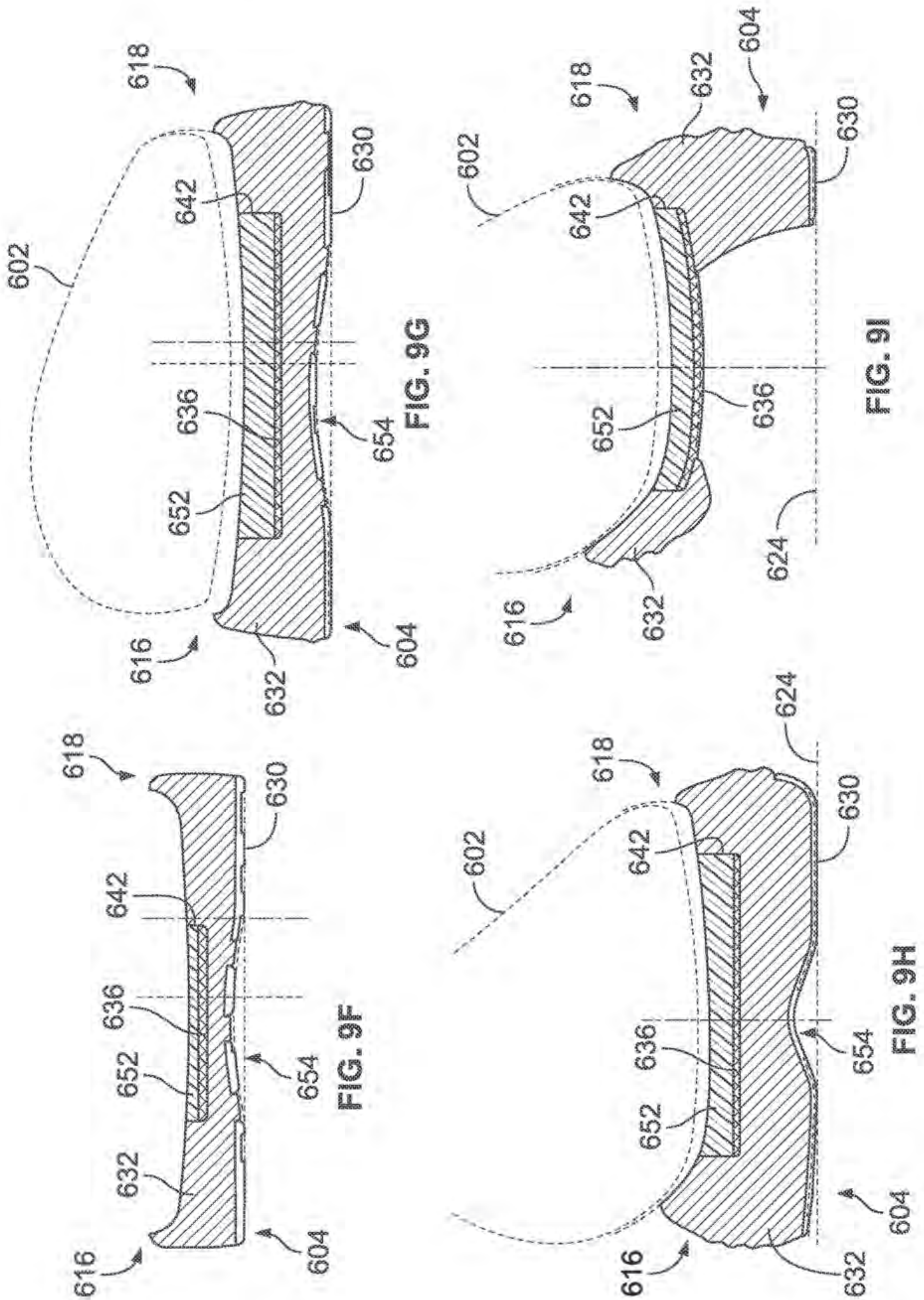

FIG. 9G

FIG. 9I

FIG. 9F

FIG. 9H

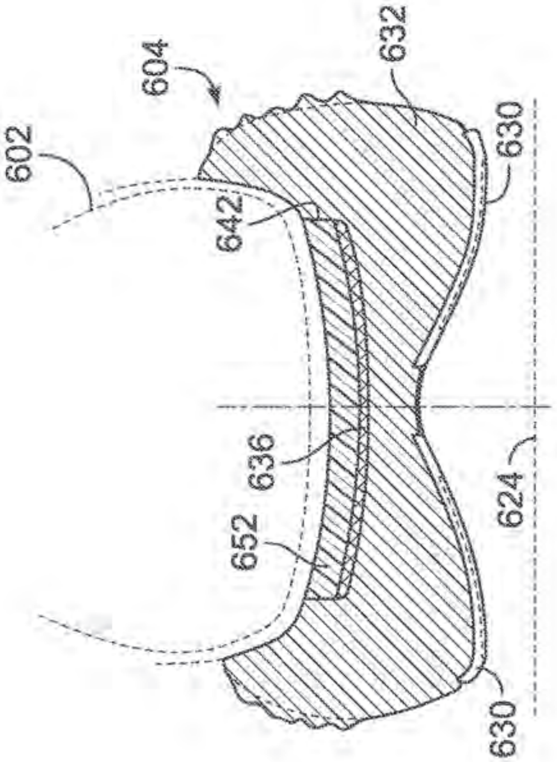

FIG. 9K

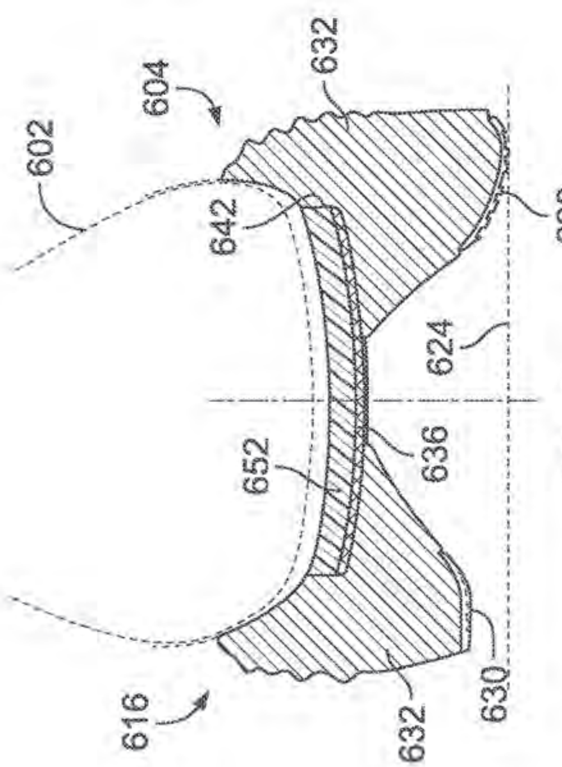

FIG. 9J

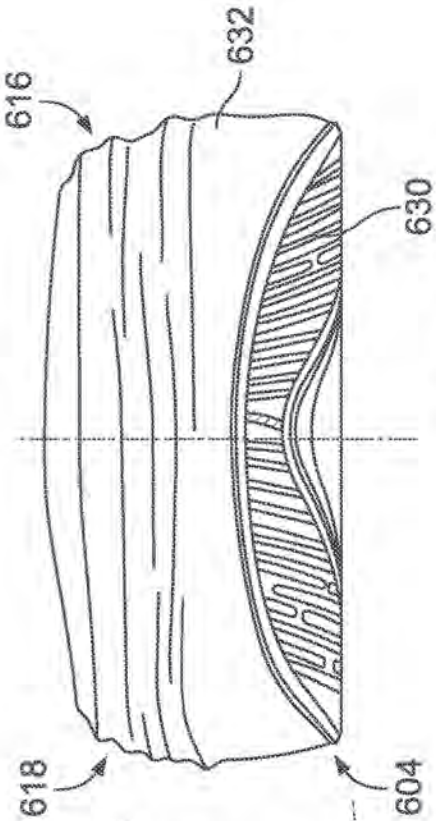

FIG. 9M

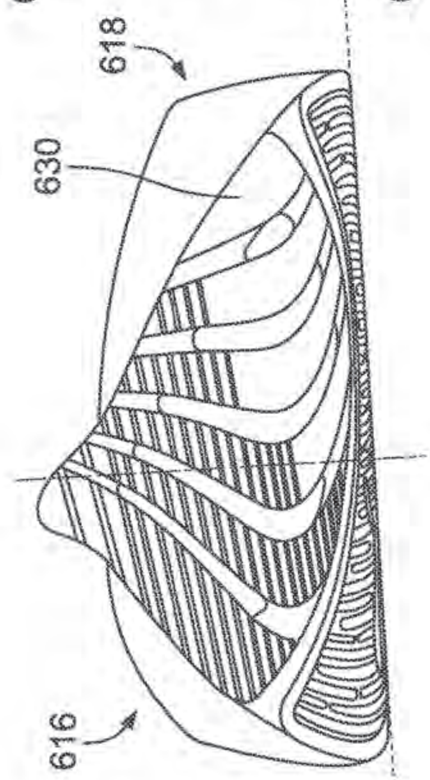

FIG. 9L

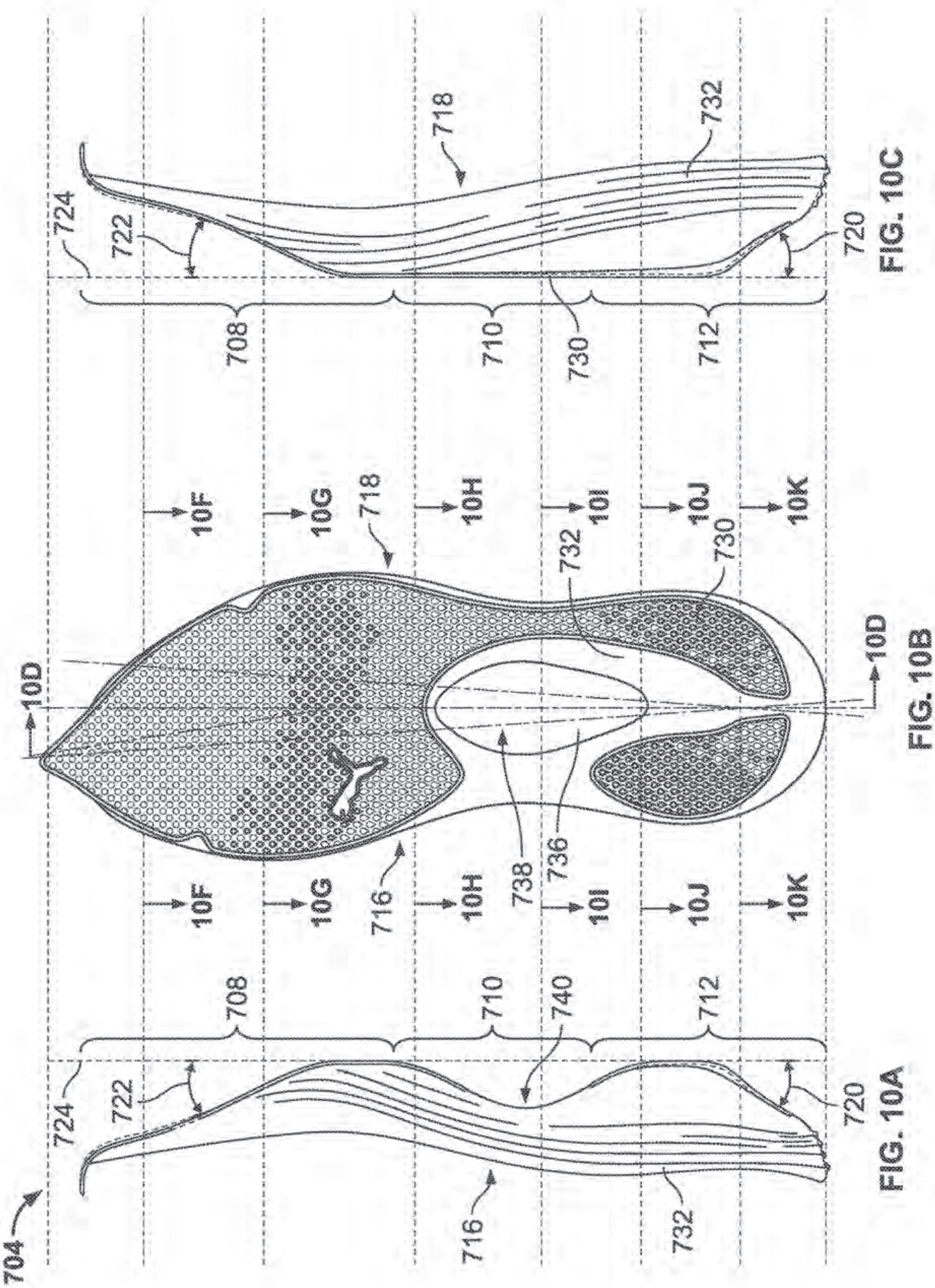

FIG. 10A

FIG. 10B

FIG. 10C

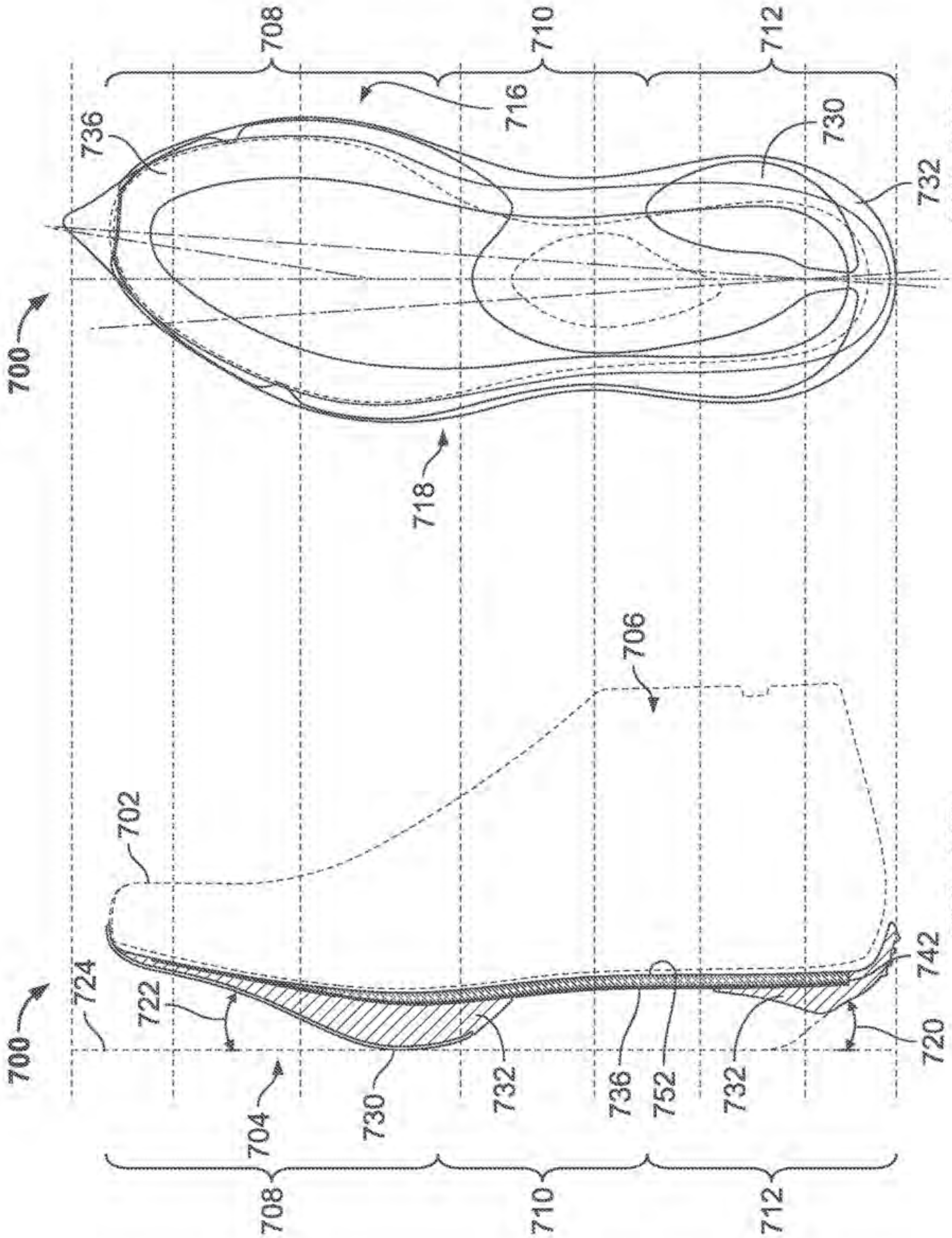

FIG. 10E

FIG. 10D

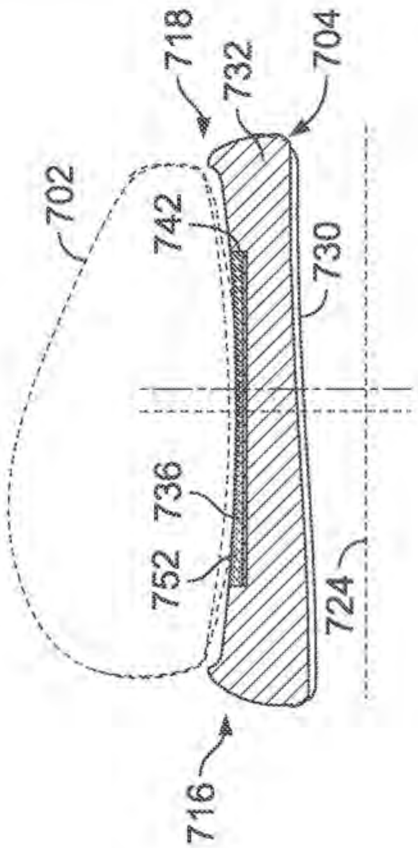

FIG. 10G

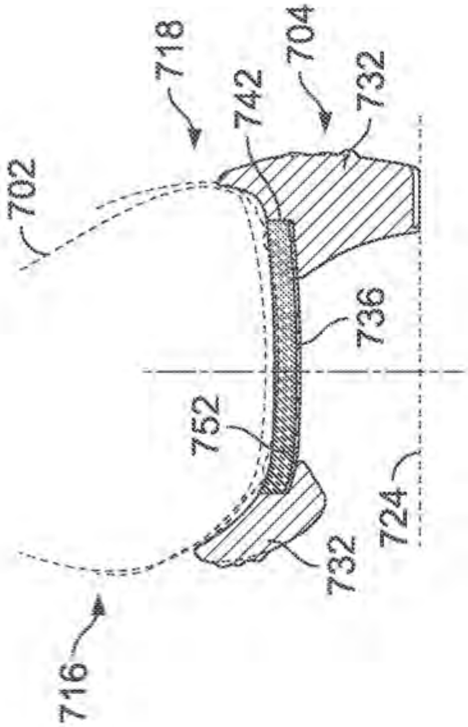

FIG. 10I

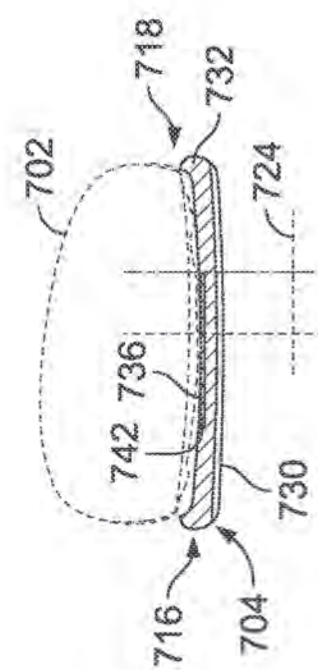

FIG. 10F

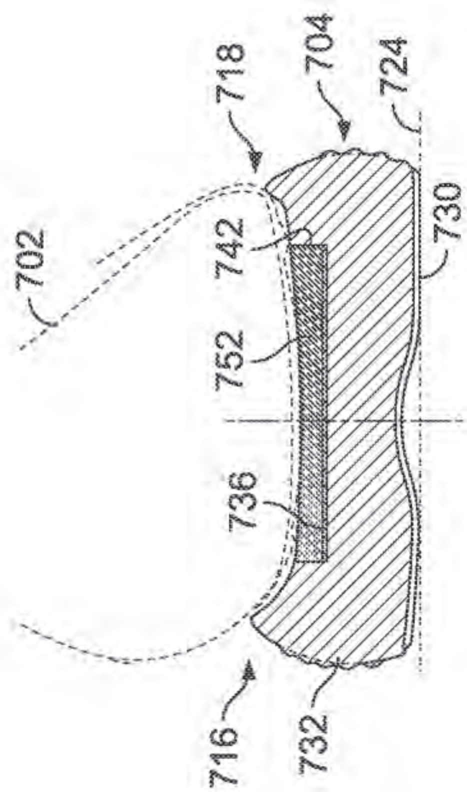

FIG. 10H

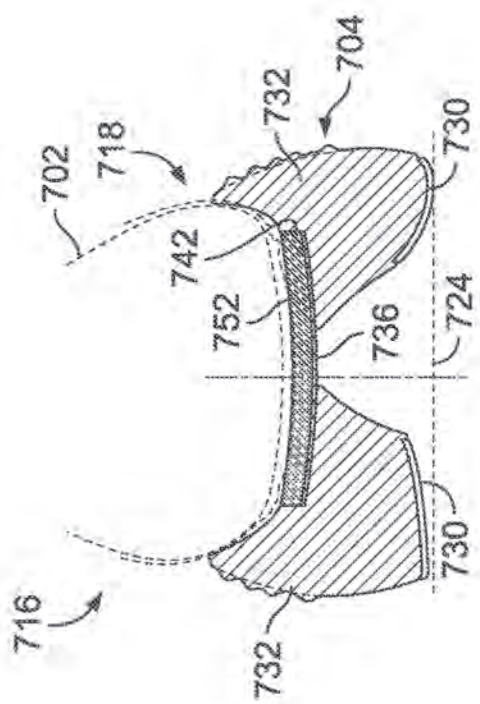

FIG. 10J

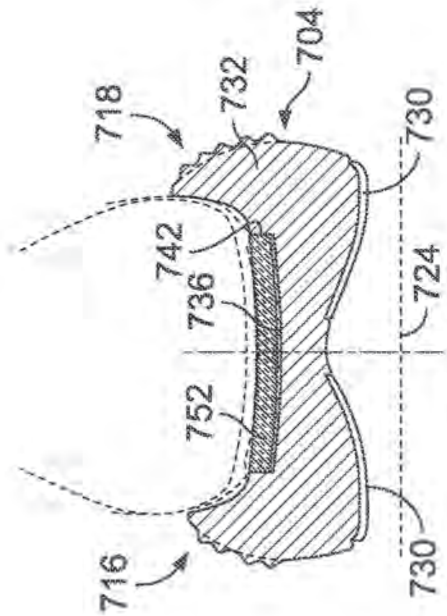

FIG. 10K

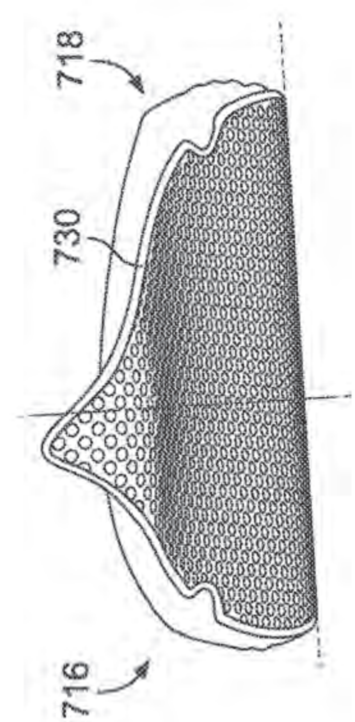

FIG. 10L

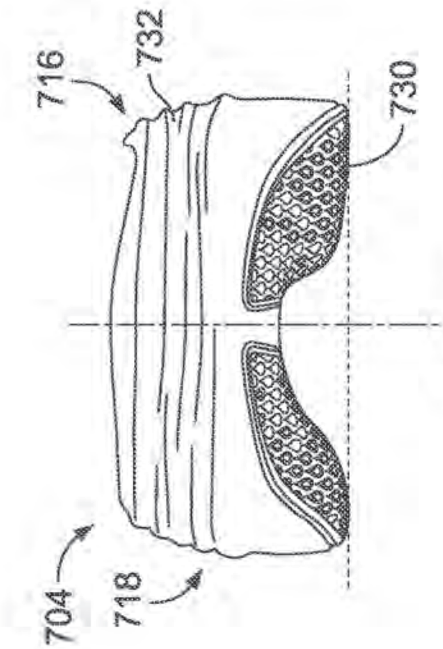

FIG. 10M

ARTICLE OF FOOTWEAR HAVING A SOLE PLATE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 17/383,954, filed Jul. 23, 2021, which claims priority to U.S. Provisional Application Ser. No. 63/055,506, filed Jul. 23, 2020, and U.S. Provisional Application Ser. No. 63/195,320, filed on Jun. 1, 2021, the contents of which are incorporated by reference herein in their entireties and are to be considered a part of this application.

REFERENCE REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

SEQUENCE LISTING

Not applicable

BACKGROUND

1. Field of the Invention

The present disclosure relates generally to an article of footwear including a sole plate.

2. Description of the Background

Many conventional shoes or other articles of footwear generally comprise an upper and a sole attached to a lower end of the upper. Conventional shoes further include an internal space, i.e., a void or cavity, which is created by interior surfaces of the upper and sole, which receives a foot of a user before securing the shoe to the foot. The sole is attached to a lower surface or boundary of the upper and is positioned between the upper and the ground. As a result, the sole typically provides stability and cushioning to the user when the shoe is being worn. In some instances, the sole may include multiple components, such as an outsole, a midsole, and an insole. The outsole may provide traction to a bottom surface of the sole, and the midsole may be attached to an inner surface of the outsole, and may provide cushioning or added stability to the sole. For example, a sole may include a particular foam material that may increase stability at one or more desired locations along the sole, or a foam material that may reduce stress or impact energy on the foot or leg when a user is running, walking, or engaged in another activity. The sole may also include additional components, such as plates, embedded with the sole to increase the overall stiffness of the sole and reduce energy loss during use.

The upper generally extends upward from the sole and defines an interior cavity that completely or partially encases a foot. In most cases, the upper extends over the instep and toe regions of the foot, and across medial and lateral sides thereof. Many articles of footwear may also include a tongue that extends across the instep region to bridge a gap between edges of medial and lateral sides of the upper, which define an opening into the cavity. The tongue may also be disposed below a lacing system and between medial and lateral sides of the upper, to allow for adjustment of shoe tightness. The tongue may further be manipulable by a user to permit entry or exit of a foot from the internal space or cavity. In addition,

the lacing system may allow a user to adjust certain dimensions of the upper or the sole, thereby allowing the upper to accommodate a wide variety of foot types having varying sizes and shapes.

The upper of many shoes may comprise a wide variety of materials, which may be utilized to form the upper and chosen for use based on one or more intended uses of the shoe. The upper may also include portions comprising varying materials specific to a particular area of the upper. For example, added stability may be desirable at a front of the upper or adjacent a heel region so as to provide a higher degree of resistance or rigidity. In contrast, other portions of a shoe may include a soft woven textile to provide an area with stretch-resistance, flexibility, air-permeability, or moisture-wicking properties.

Further, many conventional shoes or other articles of footwear, when used as a running shoe, promote an impact force at the heel region of the wearer. In particular, the impact force can be transferred from a heel of a foot, to an ankle, to a shin, to a knee, and into the hips and back of the wearer. Such impact can lead to unwanted stress on limbs when there is an instant that leg muscles are improperly tensioned and the limbs and bones are left to absorb the impact forces. The excess stress on limbs and bones can have long-term, adverse effects, such as, for example, arthrosis.

However, in many cases, articles of footwear could benefit from having uppers with an increased comfort and better fit are desired, along with soles having improved cushioning systems or structural characteristics such as a sole plate to add rigidity or spring-like properties. Additionally, articles of footwear could benefit from having a ground-engaging profile that promotes constant muscle tension to absorb and distribute impact forces are desired.

SUMMARY

An article of footwear, as described herein, may have various configurations. The article of footwear may have an upper and a sole structure connected to the upper.

According to one aspect, an article of footwear can include a sole structure and an upper. The sole structure can include an outsole having a ground engaging surface and a midsole member disposed between the outsole and the upper. The midsole can be a supercritical foam and can include a pocket that can extend from a heel region to a forefoot region. A sole plate can be disposed within the pocket and can extend from the heel region into the forefoot region. In the heel region, the sole structure can be shaped to define an entry region that can be configured to increase contact at the ground engaging surface during a heel strike. The entry region can define an angled portion that is angled at an entry angle relative to a flat ground surface.

In some embodiments, the sole structure can be shaped in the forefoot region to define an exit region that curves to angle away from the flat ground surface. The exit region can form a rocking member with a fulcrum proximate a widest portion of the sole structure. The rocking member can form a propulsion lever with the sole plate, which can be configured to propel a user forward during toe off.

In some embodiments, the sole structure can further include a cushioning layer that can be disposed between the midsole member and the upper. The cushioning layer can be positioned on top of the sole plate so that the sole plate is positioned between the midsole member and the cushioning layer. In some cases, the sole plate can be a carbon fiber plate that can be similarly shaped to and proportionally smaller

than the midsole member in at least one of the forefoot region, a midfoot region, or the heel region of the sole structure.

In some embodiments, the midsole member can define a longitudinal channel that can extend from a heel end of the sole structure and into a midfoot region. The outsole can include a first outsole member and a second outsole member that are separated from one another by the longitudinal channel so that the ground engaging surface may not be continuous across the heel region between a lateral side and medial side of the sole structure.

In some embodiments, the outsole can include a first outsole member in the forefoot region and a second outsole member in the heel region. The ground engaging surface may not continuous along a medial side of a midfoot region of the sole structure.

According to another aspect, an article of footwear can include a sole structure and an upper. The sole structure can include an outsole that can define a ground engaging surface and a midsole that can extend between the outsole and the upper. The midsole can include a first midsole member and a second midsole member, and at least one of the first midsole member or the second midsole member is a supercritical foam. The first midsole member can be coupled to the outsole and can extend from a forefoot region to a heel region of the sole structure. The first midsole member can define an entry region at a heel end in which the first midsole member is angled away from a ground surface by a first angle that is configured to increase contact at the ground engaging surface during a heel strike. The second midsole member can be coupled to the upper and can be positioned between the first midsole member and the upper. The second midsole member can extend from the heel region to the forefoot region. A sole plate can be positioned within the midsole between the first midsole member and the second midsole member.

In some embodiments, the outsole can extend at least partially into the entry region.

In some embodiments, the first midsole member can further define an exit region in the forefoot region. In the exit region, the first midsole member can curve away from the ground surface from approximately a widest portion of the sole structure to a toe end of the sole structure. In some cases, the first midsole member can define a substantially flat region between the entry region and the exit region. The first midsole member can define a rocking member between the substantially flat region and the exit region, which can create a fulcrum for the sole plate to help propel a user forward during toe off. The fulcrum can be positioned to be proximate metatarsal bones of a user.

In some embodiments, the first midsole member can define a pocket and at least one of the sole plate or the second midsole member can be disposed at least partially within the pocket. In some cases, the sole plate can be comprised of carbon fibers and extend from the heel region to the forefoot region.

According to yet another aspect, an article of footwear can include a sole structure and an upper. The sole structure can include a first midsole member and a second midsole member, and at least one of the first midsole member or the second midsole member can be a supercritical foam. The first midsole member can have a bottom surface opposite a top surface and can extend from a forefoot region to a heel region of the sole structure. The first midsole member can define an upwardly curved entry region along the bottom surface in the heel region, an upwardly curved exit region along the bottom surface in the forefoot region, and a

substantially flat region extending along the bottom surface between the entry region and the exit region. At least a portion of the entry region can be angled relative to the substantially flat region to define an entry angle. The second midsole member can be positioned between the first midsole member and the upper, and can extend from the heel region to the forefoot region. A sole plate can be positioned between the first midsole member and the second midsole member. The first midsole member can define a rocking member between the substantially flat region and the exit region. The rocking member can create a fulcrum for the sole plate to help propel a user forward during toe off.

In some embodiments, the sole plate can define a first region with a first stiffness and a second region with a second stiffness. The second stiffness can be greater than the first stiffness.

In some embodiments, the sole structure can further include an outsole that can be coupled to the bottom surface of the first midsole member. The outsole can define a ground engaging surface of the sole structure and can include a first outsole portion positioned in the forefoot region and a second outsole portion positioned in the heel region. The first outsole portion and the second outsole portion can be spaced from one another so that the ground engaging surface is not continuous between the first outsole portion and the second outsole portion.

In some embodiments, the exit region can curve upwardly from approximately a widest portion of the sole structure to a toe end of the sole structure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a medial side view of an article of footwear configured as a left shoe that includes an upper and a sole structure according to an embodiment of the disclosure;

FIG. **2** is a lateral side view of the shoe of FIG. **1**;

FIG. **3** is a bottom view of the shoe of FIG. **1**;

FIG. **4** is a top plan view of the article of footwear of FIG. **1**, with an upper removed and a user's skeletal foot structure overlaid thereon;

FIG. **5A** is a medial view of a sole structure of an article of footwear that includes a sole plate according to an embodiment of the disclosure;

FIG. **5B** is a bottom view of the sole structure of FIG. **5A**;

FIG. **5C** is a lateral side view of the sole structure of FIG. **5A**;

FIG. **5D** is a cross-sectional view of the sole structure of FIG. **5A** taken along line **5D-5D** of FIG. **5B**;

FIG. **5E** is a top view of the sole structure of FIG. **5A**;

FIG. **5F** is a cross-sectional view of the sole structure of FIG. **5A** taken along line **5F-5F** of FIG. **5B**;

FIG. **5G** is a cross-sectional view of the sole structure of FIG. **5A** taken along the line **5G-5G** of FIG. **5B**;

FIG. **5H** is a cross-sectional view of the sole structure of FIG. **5A** taken along the line **5H-5H** of FIG. **5B**;

FIG. **5I** is a cross sectional view of the sole structure of FIG. **5A** taken along the line **5I-5I** of FIG. **5B**;

FIG. **5J** is a cross-sectional view of the sole structure of FIG. **5A** taken along the line **5J-5J** of FIG. **5B**;

FIG. **5K** is a cross-sectional view of the sole structure of FIG. **5A** taken along the line **5K-5K** of FIG. **5B**;

FIG. **5L** is a toe view of the sole structure of FIG. **5A**;

FIG. **5M** is a heel view of the sole structure of FIG. **5A**;

FIG. **6A** is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. **6B** is a bottom view of the sole structure of FIG. **6A**;

FIG. 6C is a lateral side view of the sole structure of FIG. 6A;

FIG. 6D is a cross-sectional view of the sole structure of FIG. 6A taken along line 6D-6D of FIG. 6B;

FIG. 6E is a top view of the sole structure of FIG. 6A;

FIG. 6F is a cross-sectional view of the sole structure of FIG. 6A taken along line 6F-6F of FIG. 6B;

FIG. 6G is a cross-sectional view of the sole structure of FIG. 6A taken along the line 6G-6G of FIG. 6B;

FIG. 6H is a cross-sectional view of the sole structure of FIG. 6A taken along the line 6H-6H of FIG. 6B;

FIG. 6I is a cross sectional view of the sole structure of FIG. 6A taken along the line 6I-6I of FIG. 6B;

FIG. 6J is a cross-sectional view of the sole structure of FIG. 6A taken along the line 6J-6J of FIG. 6B;

FIG. 6K is a cross-sectional view of the sole structure of FIG. 6A taken along the line 6K-6K of FIG. 6B;

FIG. 6L is a toe view of the sole structure of FIG. 6A;

FIG. 6M is a heel view of the sole structure of FIG. 6A;

FIG. 7A is a medial side view of a sole structure of an article of footwear that includes a sole plate according to an embodiment of the disclosure;

FIG. 7B is a bottom view of the sole structure of FIG. 7A;

FIG. 7C is a lateral side view of the sole structure of FIG. 7A;

FIG. 7D is a cross-sectional view of the sole structure of FIG. 7A taken along line 7D-7D of FIG. 7B;

FIG. 7E is a top view of the sole structure of FIG. 7A;

FIG. 7F is a cross-sectional view of the sole structure of FIG. 7A taken along line 7F-7F of FIG. 7B;

FIG. 7G is a cross-sectional view of the sole structure of FIG. 7A taken along the line 7G-7G of FIG. 7B;

FIG. 7H is a cross-sectional view of the sole structure of FIG. 7A taken along the line 7H-7H of FIG. 7B;

FIG. 7I is a cross sectional view of the sole structure of FIG. 7A taken along the line 7I-7I of FIG. 7B;

FIG. 7J is a cross-sectional view of the sole structure of FIG. 7A taken along the line 7J-7J of FIG. 7B;

FIG. 7K is a cross-sectional view of the sole structure of FIG. 7A taken along the line 7K-7K of FIG. 7B;

FIG. 7L is a toe view of the sole structure of FIG. 7A;

FIG. 7M is a heel view of the sole structure of FIG. 7A;

FIG. 8A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. 8B is a bottom view of the sole structure of FIG. 8A;

FIG. 8C is a lateral side view of the sole structure of FIG. 8A;

FIG. 8D is a cross-sectional view of the sole structure of FIG. 8A taken along line 8D-8D of FIG. 8B;

FIG. 8E is a top view of the sole structure of FIG. 8A;

FIG. 8F is a cross-sectional view of the sole structure of FIG. 8A taken along line 8F-8F of FIG. 8B;

FIG. 8G is a cross-sectional view of the sole structure of FIG. 8A taken along the line 8G-8G of FIG. 8B;

FIG. 8H is a cross-sectional view of the sole structure of FIG. 8A taken along the line 8H-8H of FIG. 8B;

FIG. 8I is a cross sectional view of the sole structure of FIG. 8A taken along the line 8I-81 of FIG. 8B;

FIG. 8J is a cross-sectional view of the sole structure of FIG. 8A taken along the line 8J-8J of FIG. 8B;

FIG. 8K is a cross-sectional view of the sole structure of FIG. 8A taken along the line 8K-8K of FIG. 8B;

FIG. 8L is a toe view of the sole structure of FIG. 8A;

FIG. 8M is a heel view of the sole structure of FIG. 8A;

FIG. 9A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. 9B is a bottom view of the sole structure of FIG. 9A;

FIG. 9C is a lateral side view of the sole structure of FIG. 9A;

FIG. 9D is a cross-sectional view of the sole structure of FIG. 9A taken along line 9D-9D of FIG. 9B;

FIG. 9E is a top view of the sole structure of FIG. 9A;

FIG. 9F is a cross-sectional view of the sole structure of FIG. 9A taken along line 9F-9F of FIG. 9B;

FIG. 9G is a cross-sectional view of the sole structure of FIG. 9A taken along the line 9G-9G of FIG. 9B;

FIG. 9H is a cross-sectional view of the sole structure of FIG. 9A taken along the line 9H-9H of FIG. 9B;

FIG. 9I is a cross sectional view of the sole structure of FIG. 9A taken along the line 9I-91 of FIG. 9B;

FIG. 9J is a cross-sectional view of the sole structure of FIG. 9A taken along the line 9J-9J of FIG. 9B;

FIG. 9K is a cross-sectional view of the sole structure of FIG. 9A taken along the line 9K-9K of FIG. 9B;

FIG. 9L is a toe view of the sole structure of FIG. 9A;

FIG. 9M is a heel view of the sole structure of FIG. 9A;

FIG. 10A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. 10B is a bottom view of the sole structure of FIG. 10A;

FIG. 10C is a lateral side view of the sole structure of FIG. 10A;

FIG. 10D is a cross-sectional view of the sole structure of FIG. 10A taken along line 10D-10D of FIG. 10B;

FIG. 10E is a top view of the sole structure of FIG. 10A;

FIG. 10F is a cross-sectional view of the sole structure of FIG. 10A taken along line 10F-10F of FIG. 10B;

FIG. 10G is a cross-sectional view of the sole structure of FIG. 10A taken along the line 10G-10G of FIG. 10B;

FIG. 10H is a cross-sectional view of the sole structure of FIG. 10A taken along the line 10H-10H of FIG. 10B;

FIG. 10I is a cross sectional view of the sole structure of FIG. 10A taken along the line 10I-101 of FIG. 10B;

FIG. 10J is a cross-sectional view of the sole structure of FIG. 10A taken along the line 10J-10J of FIG. 10B;

FIG. 10K is a cross-sectional view of the sole structure of FIG. 10A taken along the line 10K-10K of FIG. 10B;

FIG. 10L is a toe view of the sole structure of FIG. 10A; and

FIG. 10M is a heel view of the sole structure of FIG. 10A.

DETAILED DESCRIPTION OF THE DRAWINGS

The following discussion and accompanying figures disclose various embodiments or configurations of a shoe and a sole structure. Although embodiments of a shoe or sole structure are disclosed with reference to a sports shoe, such as a running shoe, tennis shoe, basketball shoe, etc., concepts associated with embodiments of the shoe or the sole structure may be applied to a wide range of footwear and footwear styles, including cross-training shoes, football shoes, golf shoes, hiking shoes, hiking boots, ski and snowboard boots, soccer shoes and cleats, walking shoes, and track cleats, for example. Concepts of the shoe or the sole structure may also be applied to articles of footwear that are considered non-athletic, including dress shoes, sandals, loafers, slippers, and heels.

In addition to footwear, particular concepts described herein may also be applied and incorporated in other types

of apparel or other athletic equipment, including helmets, padding or protective pads, shin guards, and gloves. Even further, particular concepts described herein may be incorporated in cushions, backpack straps, golf clubs, or other consumer or industrial products. Accordingly, concepts described herein may be utilized in a variety of products.

The term "about," as used herein, refers to variation in the numerical quantity that may occur, for example, through typical measuring and manufacturing procedures used for articles of footwear or other articles of manufacture that may include embodiments of the disclosure herein; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or mixtures or carry out the methods; and the like. Throughout the disclosure, the terms "about" and "approximately" refer to a range of values±5% of the numeric value that the term precedes.

The terms "weight percent," "wt-%," "percent by weight," "% by weight," and variations thereof, as used herein, refer to the concentration of a substance or component as the weight of that substance or component divided by the total weight, for example, of the composition or of a particular component of the composition, and multiplied by 100. It is understood that, as used herein, "percent," "%," and the like may be synonymous with "weight percent" and "wt-%."

The present disclosure is directed to an article of footwear and/or specific components of the article of footwear, such as an upper and/or a sole or sole structure. The upper may comprise a knitted component, a woven textile, and/or a non-woven textile. The knitted component may be made by knitting of yarn, the woven textile by weaving of yarn, and the non-woven textile by manufacture of a unitary non-woven web. Knitted textiles include textiles formed by way of warp knitting, weft knitting, flat knitting, circular knitting, and/or other suitable knitting operations. The knit textile may have a plain knit structure, a mesh knit structure, and/or a rib knit structure, for example. Woven textiles include, but are not limited to, textiles formed by way of any of the numerous weave forms, such as plain weave, twill weave, satin weave, dobbin weave, jacquard weave, double weaves, and/or double cloth weaves, for example. Non-woven textiles include textiles made by air-laid and/or spun-laid methods, for example. The upper may comprise a variety of materials, such as a first yarn, a second yarn, and/or a third yarn, which may have varying properties or varying visual characteristics.

FIGS. **1-3** depict an embodiment of an article of footwear **100**, configured as a shoe, including an upper **102** and a sole structure **104**. The upper **102** is attached to the sole structure **104** and together define an interior cavity **106** into which a foot may be inserted. For reference, the article of footwear **100** defines a forefoot region **108**, a midfoot region **110**, and a heel region **112**. The forefoot region **108** generally corresponds with portions of the article of footwear **100** that encase portions of the foot that include the toes, the ball of the foot (shown in FIG. **4**), and joints connecting the metatarsals with the toes or phalanges (also shown in FIG. **4**). The midfoot region **110** is proximate and adjoining the forefoot region **108**, and generally corresponds with portions of the article of footwear **100** that encase the arch of a foot, along with the bridge of a foot. The heel region **112** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

While only a single article of footwear is depicted, i.e., a shoe that is worn on a left foot of a user, it should be appreciated that the concepts disclosed herein are applicable to a pair of shoes (not shown), which includes a left shoe and a right shoe that may be sized and shaped to receive a left foot and a right foot of a user, respectively. For ease of disclosure, a single shoe will be referenced to describe aspects of the disclosure. The disclosure below with reference to the article of footwear **100** is applicable to both a left shoe and a right shoe. However, in some embodiments there may be differences between a left shoe and a right shoe other than the left/right configuration. Further, in some embodiments, a left shoe may include one or more additional elements that a right shoe does not include, or vice versa.

Many conventional footwear uppers are formed from multiple elements (e.g., textiles, polymer foam, polymer sheets, leather, and synthetic leather) that are joined through bonding or stitching at a seam. In some embodiments, the upper **102** of the article of footwear **100** is formed from a knitted structure or knitted components. In various embodiments, a knitted component may incorporate various types of yarn that may provide different properties to an upper. For example, one area of the upper **102** may be formed from a first type of yarn that imparts a first set of properties, and another area of the upper **102** may be formed from a second type of yarn that imparts a second set of properties. Using this configuration, properties of the upper **102** may vary throughout the upper **102** by selecting specific yarns for different areas of the upper **102**. In another example, an upper mesh layer may be warp knit, while a mesh backing layer may comprise a circular knit.

The article of footwear **100** also includes a medial side **116** illustrated in FIG. **1** and a lateral side **118** illustrated in FIG. **2**. In particular, when a user is wearing the article of footwear **100**, the lateral side **118** corresponds to an outside-facing portion of the article of footwear **100** and the medial side **116** corresponds to an inside-facing portion of the article of footwear **100**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **116** are closest to one another when a user is wearing the articles of footwear **100**, while the lateral sides **118** are defined as the sides that are farthest from one another while being worn. The medial side **116** and the lateral side **118** adjoin one another at opposing, distal ends of the article of footwear **100**.

Unless otherwise specified, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** are intended to define boundaries or areas of the article of footwear **100**. To that end, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** generally characterize sections of the article of footwear **100**. Further, both the upper **102** and the sole structure **104** may be characterized as having portions within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**. Therefore, the upper **102** and the sole structure **104**, and/or individual portions of the upper **102** and the sole structure **104**, may include portions thereof that are disposed within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**.

Referring to FIG. **4**, the forefoot region **108** may generally correspond with portions of the article of footwear **100** that encase portions of a foot **10** that include the toes or phalanges **12**, the ball **14** of the foot **10**, and one or more of the joints **16** that connect the metatarsals **18** of the foot **10** with the toes or phalanges **12**. The midfoot region **110** is proxi-

mate and adjoins the forefoot region **108**. The midfoot region **110** generally corresponds with portions of the article of footwear **100** that encase an arch **20** of a foot **10**, along with a bridge **22** of the foot **10**. The heel region **112** is proximate to the midfoot region **110** and adjoins the midfoot region **110**. The heel region **112** generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot **10**, including the heel or calcaneus bone **24**, the ankle (not shown), and/or the Achilles tendon (not shown).

The sole structure **104** is connected or secured to the upper **102** and extends between a foot of a user and the ground when the article of footwear **100** is worn by the user. The sole structure **104** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system (e.g., one or more midsole members, which can be configured as cushion layers), and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **104** of the present embodiment of the invention includes one or more components that provide the sole structure **104** with preferable spring and damping properties.

The sole structure **104** includes an outsole **130**, a first midsole member **132** (e.g., a first cushion layer), a second midsole member **134** (e.g., a second cushion layer), and a sole plate **136** (see, for example FIG. **3**). The first midsole member **132**, the second midsole member **134**, and the sole plate **136** can form a cushioning system of the sole structure **104** (e.g., a midsole of the sole structure **104**). The outsole **130** may define a bottom end or surface of the sole structure **104** across the heel region **112**, the midfoot region **110**, and the forefoot region **108**. Further, the outsole **130** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **104** and may be opposite of the insole thereof. The outsole **130** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **104**. In some embodiments, the outsole **130** may be formed from rubber, for example.

Together, the first midsole member **132** and the second midsole member **134** form a midsole and may be positioned adjacent to and on top of the outsole **130** in the heel region **112** and partially in the midfoot region **110** and forefoot region **108**. The first midsole member **132** and the second midsole member **134** define a cutout portion **138**. The first midsole member **132** may be constructed from a thermoplastic material, such as polyurethane (PU) plastic, for example and the second midsole member **134** may be constructed from ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, each of the first midsole member **132** and the second midsole member **134** may be constructed from the same material.

In other embodiments, the first midsole member **132** and/or the second midsole member **134** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first midsole member **132** and/or the second midsole member **134** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer.

The sole structure further includes the sole plate **136** disposed between the second midsole member **134** and the upper **102**. As shown in FIG. **3**, the sole plate **136** extends at least partially through the midfoot region **110** and is exposed at the cutout portion **138**. The sole plate **136** is also disposed adjacent an arched section **140** of the article of footwear **100**.

In some embodiments, the ground-engaging surface is not continuous along the medial side **116** of the midfoot region **110** of the article of footwear. For example, as illustrated in FIG. **3**, the outsole **130** partially surrounds the arched section **140**, the first midsole member **132** partially surrounds and partially defines the arched section **140**, and the second midsole member **134** surrounds and partially defines the arched section **140**.

In some embodiments, the sole plate **136** comprises a polyurethane (PU) plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers are also possible. In other embodiments, the sole plate **136** can include carbon fiber, for example. In some embodiments, these and other rigid, semi-rigid, or spring-like materials and combinations thereof may comprise the sole plate **136**. The sole plate **136** can have varied stiffness along the length of the sole plate **136**. For example, the stiffness in the forefoot region **108** of the sole plate **136** may be more or less flexible than the midfoot region **110** of the sole plate **136**, which may be more or less flexible than the heel region **112** of the sole plate **136**. Alternatively, the sole plate **136** can include a uniform stiffness. Additionally, the sole plate **136** may include additional or alternative geometries, such as, for example, notches, curves, protrusions, voids, angled edges, cutouts, etc. In some embodiments, the sole plate **136** can be configured as a shock plate to impart impact protection and facilitate leg muscle tension, thereby relieving stress on a heel, ankle, shin, knees, hips, and/or back of a user.

FIGS. **5**A through **5**M depict an exemplary embodiment of a sole structure **204** according to one embodiment of the invention. Similar to the sole structure **104**, the sole structure **204** is configured to be attached to an upper **202** and together define an interior cavity **206** of an article of footwear **200** (shown in FIG. **5**D) into which a foot may be inserted. For reference the sole structure **204** defines a forefoot region **208**, a midfoot region **210**, and a heel region **212**. The forefoot region **208** generally corresponds with portions of an article of footwear, such as the article of footwear **100**, for example, that encase portions of the foot that include the toes, the ball of the foot (shown in FIG. **4**), and joints connecting the metatarsals with the toes or phalanges (also shown in FIG. **4**). The midfoot region **210** is proximate and adjoining the forefoot region **208**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **212** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon (shown in FIG. **4**).

The sole structure **204** also includes a medial side **216** illustrated in FIG. **5**A and a lateral side **218** illustrated in FIG. **5**C. In particular, the lateral side **218** corresponds to an outside portion of the article of footwear and the medial side **216** corresponds to an inside portion of the article of footwear. As such, left and right articles of footwear have

opposing lateral and medial sides, such that the medial sides **216** are closest to one another when a user is wearing the articles of footwear, while the lateral sides **218** are defined as the sides that are farthest from one another while being worn. The medial side **216** and the lateral side **218** adjoin one another at opposing, distal ends of the article of footwear.

Unless otherwise specified, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** are intended to define boundaries or areas of the article of footwear. To that end, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** generally characterize sections of the article of footwear. Further, both the upper **202** and the sole structure **204** may be characterized as having portions within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**. Therefore, the upper **202** and the sole structure **204**, and/or individual portions of the upper **202** and the sole structure **204**, may include portions thereof that are disposed within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**.

The sole structure **204** is connected or secured to the upper **202** and extends between a foot of a user and the ground when the article of footwear is worn by the user. The sole structure **204** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system (e.g., one or more midsole members, which can be configured as cushioning layers), and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **204** of the present embodiment of the invention includes one or more components that provide the sole structure **204** with preferable spring and damping properties.

The sole structure **204** includes an outsole **230**, a first midsole member **232** (e.g., a first cushion layer), a second midsole member **234** (e.g., a second cushion layer), and a sole plate **236**. The first midsole member **232**, the second midsole member **234**, and the sole plate **236** can form a cushioning system of the sole structure **204** (e.g., a midsole of the sole structure **204**). The first midsole member **232** is coupled to the outsole **230** and the second midsole member **234** is positioned between the first midsole member **232** and the upper **202**. The outsole **230** may define a bottom end or surface of the sole structure **204** across the heel region **212**, the midfoot region **210**, and the forefoot region **208**. Further, the outsole **230** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **204** and may be opposite of the insole thereof. The outsole **230** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **204**. In some embodiments, the outsole **230** may be formed from rubber, for example.

When in a rested state as shown in FIGS. **5A-5M**, the sole structure **204** is shaped to define an entry angle **220** in the heel region **212** and an exit angle **222** in the forefoot region **208** with respect to a flat ground surface **224**. More specifically, the first midsole member **232**, the second midsole member **234**, and the outsole **230** can be shaped to define the entry angle **220** and the exit angle **222**. The sole structure **204** can also define a substantially flat region **219** that is approximately parallel with the flat ground surface **224**. In some embodiments, the entry angle **220** can be about 30 degrees. Correspondingly, the sole structure **204** can define an entry region **221** in which a bottom surface **205** (e.g., a ground-engaging surface) of the sole structure **204** curves upwardly to start angling away from the ground surface **224** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). In some embodiments, the exit angle **222** can be about 15 degrees. Correspondingly, the sole structure **204** can also define an exit region **223** in which the bottom surface **205** of the sole structure **204** curves to start angling away from the ground surface **224** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

The entry and exit angles **220**, **224** can be configured to enhance contact with a user's heel during a heel strike and promoting engagement of a large surface area of the outsole **230** in the forefoot region **208** during a push-off by the user. Accordingly, the entry region **221** can extend rearward from the substantially flat region **219** and the exit region **223** can extend forward from the substantially flat region **219**. In some embodiments, the junction between the substantially flat region **219** and the exit region **223** can be located at a widest portion **207** of the sole structure **204** (e.g., at a greatest distance between the medial and lateral sides **216**, **218**), so as to be aligned proximate to the metatarsal bones of the user.

Due to the curved nature of each of the entry region **221** and the exit region **223**, the respective junctions with the substantially flat region **219** can form rocking regions **225**, **227** (e.g., rocking members). The rocking regions **225**, **227** can create a fulcrum for the sole plate **236**. For example, the fulcrum created by the rocking region **227** can create a propulsion lever with the sole plate **236** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward.

The first midsole member **232** and the second midsole member **234** may be positioned adjacent and on top of the outsole **230** in the heel region **212** and partially in the midfoot region **210** and forefoot region **208**, with the first midsole member **232** concentrated in the areas underneath the balls and heel of a user's foot. The first midsole member **232** and the second midsole member **234** define a cutout portion **238**. The first midsole member **232** may be constructed from a thermoplastic material, such as PU, for example and the second midsole member **234** may be constructed from EVA, copolymers thereof, or a similar type of material. In other embodiments, each of the first midsole member **232** and the second midsole member **234** may be constructed from the same material. In some embodiments, the first midsole member **232** and/or the second midsole member **234** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first midsole member **232** and/or the second midsole member **234** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer.

The sole structure further includes the sole plate **236** disposed between the second midsole member **234** and the upper **202**. As shown in FIGS. **5D** and **5E**, the sole plate **236** extends through the midfoot region **210** and is exposed at the cutout portion **238** within an arched section **240** illustrated in FIG. **5B**. Further illustrated in FIG. **5B**, the outsole **230** partially surrounds the arched section **240**, the first midsole

member **232** partially surrounds and partially comprises the arched section **240**, and the second midsole member **234** surrounds and partially comprises the arched section **240**.

In some embodiments, the ground-engaging surface is not continuous along the medial side **216** of the midfoot region **210** of the article of footwear. Correspondingly, the outsole **230** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **5**B, the outsole **230** includes a first outsole portion **230***a* positioned in the forefoot region **208** and generally forward of the widest portion **207** (e.g., to extend into the exit region **223**). Additionally, the outsole **230** includes a second outsole portion **230***b* extending from the widest portion **207**, along the lateral side **218** of the midfoot region **410**, and around a periphery of the heel region **212** to the medial side **216** (e.g., to extend into the entry region **221**).

In some embodiments, for example, as illustrated in FIGS. **5**B, and **5**I-**5**M, the first midsole member **232** can define a longitudinal channel **233** that extends from the heel region **212** and into the midfoot region **210**.

Illustrated in FIG. **5**E, the sole plate **236** extends between the heel region **212** and the forefoot region **208** and includes a plurality of cutouts **250** in the forefoot region **208**. The plurality of cutouts **250** are oriented to approximate the angle of the path of the ball of user's foot (shown in FIG. **4**) from medial side to lateral side. The plurality of cutouts **250** provide reliefs in the sole plate **250** allowing it to bend and flex more easily at the cutouts **250**. Generally, the sole plate **236** has a shape that is similar to but proportionally smaller than the midsole member **232** in the midfoot and heel regions **210**, **212**. In the forefoot region **218**, the sole plate **236** has an irregular periphery, wherein the periphery extends inward in the spaces between the cutouts **250**. Decreasing the width of the sole plate **236** in the spaces between the cutouts **250** increases the flexibility of the sole plate **236** in the forefoot region **218** by making the sole plate **236** easier to bend. Illustrated in FIGS. **5**F through **5**K, the sole plate **236** has a uniform thickness. In some embodiments, the thickness of the sole plate **236** is approximately 1.2 millimeters. In some embodiments, the sole plate **236** can be configured as a shock plate to impart impact protection and facilitate leg muscle tension thereby relieving stress on a heel, ankle, shin, knees, hips, and/or back of a user.

Continuing, FIGS. **5**F and **5**G show cross-sectional views of the forefoot region **208** of the article of footwear **200** along lines **5**F-**5**F and **5**G-**5**G in FIG. **5**B. In FIG. **5**F, the sole plate **236** is shown extending between the medial side **216** and the lateral side **218** and positioned within a pocket **242** and exposed along the top of the second midsole member **234**. In FIG. **5**G, the second midsole member **234** is shown extending through one of the plurality of cutouts **250** and contacting the upper **202**. FIG. **5**G further shows the first midsole member **232** in contact with the second midsole member **234** and the outsole **230** along the medial side **216**.

FIGS. **5**H and **5**I illustrate cross-sectional views of the midfoot region **210** of the article of footwear **200** along lines **5**H-**5**H and **5**I-**5**I of FIG. **5**B. The sole plate **236** is positioned within the pocket **242** and exposed along the top of the second midsole member **234** in FIG. **5**H. Further, the second midsole member **234** extends continuously from medial side **216** to the lateral side **218** and the first midsole member **232** is sandwiched between the second sole member **234** and the outsole **230**, with both the first midsole member **232** and the outsole **230** also extending continuously from the medial side **216** to the lateral side **218**. Looking at FIGS. **5**A, **5**C, and **5**D, and as mentioned above, this portion of the sole structure **204** is located underneath the ball of a user's foot (shown in FIG. **4**) and creates a rocking member (i.e., a rocking region) with a fulcrum proximate to the metatarsal bones of the user. The position of the sole plate **236** in relation to the first and second midsole members **232**, **234** effectively adjusts the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

Continuing, in FIG. **5**G, the sole plate **236** is also shown positioned within and exposed along the top of the second midsole member **234** but also exposed through the cutout portion **238**. The first midsole member **232** is only shown along the lateral side **218**. Along the medial side **216**, the second midsole member **234** is spaced from the ground surface **224** and is configured to be capable of engaging an elevated ground surface or other external surface at the midfoot region **210**.

Further, FIGS. **5**J and **5**K show cross-sectional views of the heel region **212** of the article of footwear **200** along lines **5**J-**5**J and **5**K-**5**K of FIG. **5**B. The sole plate **236** is positioned within the pocket **242** of the second midsole member **234** as shown in both FIGS. **5**J and **5**K, but is exposed through the cutout portion **238** in at least the area of the heel region **212** of the sole structure **204** shown in FIG. **5**J. Additionally, the first midsole member **232** is positioned between the second midsole member **234** and the outsole **230** along both the medial side **216** and the lateral side **218** of the heel region **212**. In FIG. **5**K, the sole plate **236** is shown positioned within the pocket **242** and exposed along the top of the second midsole member **234**. Further, the second midsole member **234** extends continuously from the medial side **216** to the lateral side **218**. The first midsole member **232** is positioned between the second midsole member **234** and the outsole **230**. Both the first midsole member **232** and the outsole **230** extend continuously from the medial side **216** to the lateral side **218**.

In some embodiments, the sole plate **236** comprises a PU plastic, such as a TPU material, for example. Other thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers are also possible. In other embodiments, the sole plate **236** can include carbon fiber, for example. However, these and other rigid, semi-rigid, or spring-like materials and combinations thereof may comprise the sole plate **236**. The sole plate **236** can have varied stiffness along the length of the sole plate **236**. For example, the stiffness in the forefoot region **208** of the sole plate **236** may be more or less flexible than the midfoot region **210** of the sole plate **236**, which may be more or less flexible than the heel region **212** of the sole plate **236**. Alternatively, the sole plate **236** can include a uniform stiffness. Additionally, the sole plate **236** may include additional or alternative geometries, such as, for example, notches, curves, protrusions, voids, angled edges, cutouts, etc.

FIGS. **5**L and **5**G illustrate a toe view and a heel view, respectively, of the article of footwear **200**. The outsole **230** extends up and around the second midsole member **234** and at least a portion of the upper **202** in the front of the forefoot region **208** (shown in FIGS. **5**A, **5**C and **5**D).

FIGS. **6**A through **6**M depict an exemplary embodiment of a sole structure **304** according to one embodiment of the disclosure. Similar to the sole structures **104** and **204**, the sole structure **304** is configured to be attached to an upper **302** and together define an interior cavity of an article of footwear **300** (shown in FIG. **6**D) into which a foot may be inserted. For reference the sole structure **304** defines a forefoot region **308**, a midfoot region **310**, and a heel region

312. The forefoot region **308** generally corresponds with portions of an article of footwear, such as the article of footwear **100**, for example, that encase portions of the foot that include the toes, the ball of the foot (shown in FIG. **4**), and joints connecting the metatarsals with the toes or phalanges (also shown in FIG. **4**). The midfoot region **310** is proximate and adjoining the forefoot region **308**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **312** is proximate and adjoining the midfoot region **310** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon (shown in FIG. **4**).

The sole structure **304** also includes a medial side **316** illustrated in FIG. **6**A and a lateral side **318** illustrated in FIG. **6**C. In particular, the lateral side **318** corresponds to an outside portion of the article of footwear and the medial side **316** corresponds to an inside portion of the article of footwear. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **316** are closest to one another when a user is wearing the articles of footwear, while the lateral sides **318** are defined as the sides that are farthest from one another while being worn. The medial side **316** and the lateral side **318** adjoin one another at opposing, distal ends of the article of footwear.

Unless otherwise specified, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** are intended to define boundaries or areas of the article of footwear. To that end, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** generally characterize sections of the article of footwear. Further, both the upper **302** and the sole structure **304** may be characterized as having portions within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**. Therefore, the upper **302** and the sole structure **304**, and/or individual portions of the upper **302** and the sole structure **304**, may include portions thereof that are disposed within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**.

The sole structure **304** is connected or secured to the upper **302** and extends between a foot of a user and the ground when the article of footwear is worn by the user. The sole structure **304** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system (e.g., one or more midsole members, which can be configured as cushioning layers), and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **304** of the present embodiment of the invention includes one or more components that provide the sole structure **304** with preferable spring and damping properties.

The sole structure **304** includes an outsole **330**, a midsole member **332** (e.g., a first midsole member or cushion layer), a sole plate **336**, and a cushion layer **352** (e.g., a second midsole member or cushion layer). The midsole member **332**, the cushion layer **352**, and the sole plate **336** can form a cushioning system of the sole structure **304** (e.g., a midsole of the sole structure **304**). The outsole **330** may define a bottom end or surface of the sole structure **304** across the heel region **312**, the midfoot region **310**, and the forefoot region **308**. Further, the outsole **330** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **304** and may be opposite of the insole thereof. The outsole **330** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **304**. In some embodiments, the outsole **330** may be formed from rubber, for example. Similar to the outsole **230**, the outsole **330** can have an entry angle **320** in the heel region **312** and an exit angle **322** in the forefoot region **308** relative to a ground surface **324**. Further, in some embodiments, the entry angle **320** can be about 30 degrees, and in some embodiments the exit angle **322** can be about 15 degrees.

Accordingly, when in a rested state as shown in FIGS. **6**A-**6**M, the sole structure **304** is shaped to define an entry angle **320** in the heel region **312** and an exit angle **322** in the forefoot region **308** with respect to a flat ground surface **324**. The sole structure **304** can also define a substantially flat region **319** that is approximately parallel with the flat ground surface **324**. Correspondingly, the sole structure **304** can define an entry region **321** in which a bottom surface **305** (e.g., a ground-engaging surface) of the sole structure **304** curves upwardly to start angling away from the ground surface **324** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Correspondingly, the sole structure **304** can also define an exit region **323** in which the bottom surface **305** of the sole structure **304** curves upwardly to start angling away from the ground surface **324** approximate the area underneath the ball of a user's foot (shown in FIG. **4**).

The entry and exit angles **320**, **324** can be configured to enhance contact with a user's heel during a heel strike and promote engagement of a large surface area of the outsole **330** in the forefoot region **308** during a push-off by the user. Accordingly, the entry region **321** can extend rearward from the substantially flat region **319** and the exit region **323** can extend forward from the substantially flat region **319**. In some embodiments, the junction between the substantially flat region **319** and the exit region **323** can be located at a widest portion **307** of the sole structure **304** (e.g., at a greatest distance between the medial and lateral sides **316**, **318**), so as to be aligned proximate to the metatarsal bones of the user.

Due to the curved nature of each of the entry region **321** and the exit region **323**, the respective junctions with the substantially flat region **319** can form rocking regions **325**, **327** (e.g., rocking members). The rocking regions **325**, **327** can create a fulcrum for the sole plate **336**. For example, the fulcrum created by the rocking region **327** can create a propulsion lever with the sole plate **336** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward.

The midsole member **332** may be positioned adjacent and on top of the outsole **330** in the heel region **312** and partially in the midfoot region **310** and forefoot region **308**. The midsole member **332** may define a cutout portion **338**. The midsole member **332** can be constructed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. The midsole member **332** may be constructed from a thermoplastic elastomer material such as a polyether block amide (PEBA). One example of a PEBA material is PEBAX® foam. In some embodiments, the midsole member **332** can be constructed from an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic

polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The midsole member **332** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a PEBA copolymer, and/or an olefin block copolymer.

The sole structure further includes the sole plate **336** disposed between the midsole member **332** and the upper **302**. As shown in FIGS. **6**D and **6**E, the sole plate **336** extends through the midfoot region **310** and is exposed at the cutout portion **338** within an arched section **340** illustrated in FIG. **6**B. Further illustrated in FIG. **6**B, the outsole **330** partially surrounds the arched section **340** and the midsole member **332** partially surrounds and partially comprises the arched section **340**.

In some embodiments, the ground-engaging surface is not continuous along the medial side **316** of the midfoot region **310** of the article of footwear. Correspondingly, the outsole **330** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **6**B, the outsole **330** includes a first outsole portion **330***a* positioned in the forefoot region **308** and generally forward of the widest portion **307** (e.g., to extend into the exit region **323**). Additionally, the outsole **330** includes a second outsole portion **330***b* extending from the widest portion **307**, along the lateral side **318** of the midfoot region **410**, and around a periphery of the heel region **312** to the medial side **316** (e.g., to extend into the entry region **321**).

In some embodiments, for example, as illustrated in FIGS. **6**B, and **6**I-**6**M, the first midsole member **332** can define a longitudinal channel **333** that extends from the heel region **312** and into the midfoot region **310**.

Illustrated in FIG. **6**E, the sole plate **336** extends between the heel region **312** and the forefoot region **308**. Illustrated in FIGS. **6**F through **6**K, the sole plate **336** has a uniform thickness throughout of approximately 0.8 millimeters. Generally, the sole plate **336** has a shape that is similar to but proportionally smaller than the midsole member **332** throughout the forefoot, midfoot, and heel regions **308**, **310**, **312** (shown in FIG. **6**E). In some embodiments, the sole plate **336** comprises carbon fiber, for example. In other embodiments, the sole plate **336** can include a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers are also possible. However, these and other rigid, semi-rigid, or spring-like materials and combinations thereof may comprise the sole plate **336**. In some embodiments, the sole plate **336** can be configured as a shock plate to impart impact protection and facilitate leg muscle tension thereby relieving stress on a heel, ankle, shin, knees, hips, and/or back of a user.

The sole plate **336** can have varied stiffness along the length of the sole plate **336**. For example, the stiffness in the forefoot region **308** of the sole plate **336** may be more or less flexible than the midfoot region **310** of the sole plate **336**, which may be more or less flexible than the heel region **312** of the sole plate **336**. Alternatively, the sole plate **336** can include a uniform stiffness. Additionally, the sole plate **336** may include additional or alternative geometries, such as, for example, notches, curves, protrusions, voids, angled edges, cutouts, etc. The sole plate **336** further defines an outer periphery that would fit into a peripheral envelope of a pocket formed in the sole structure **304** (e.g., a midsole member thereof).

The cushion layer **352** extends between the heel region **312** and the midfoot region **310** as illustrated in FIG. **6**J and is positioned on top at least a portion of the sole plate **336** and between the sole plate **336** and the upper **302**. The cushion layer **352** is configured as a thin foam layer having a thickness of approximately 4 millimeters in the heel region **312** and a portion of the midfoot region **310**. In some embodiments, the cushion layer **352** can be constructed from a thermoplastic elastomer material such as a polyether block amide (PEBA). One example of a PEBA material is PEBAX® foam. In a portion of the midfoot region **310** the cushion layer **352** tapers to a thickness of zero so that there is little to no cushion layer **352** present in the forefoot region **308**. However, in some embodiments, the cushion layer **352** can extend at least partially into the forefoot region **308**.

Continuing, FIGS. **6**F and **6**G show cross-sectional views of the forefoot region **308** of the article of footwear **300** along lines **6**F-**6**F and **6**G-**6**G in FIG. **6**B. In both FIGS. **6**F and **6**G the sole plate **336** is shown positioned within a pocket **342** and exposed along the top of the midsole member **332** and in contact with the upper **302**. The sole plate **336** also extends between the medial side **316** and the lateral side **318**.

FIGS. **6**H and **6**I illustrate cross-sectional views of the midfoot region **310** along lines **6**H-**6**H and **6**I-**6**I of FIG. **6**B. In FIG. **6**H, the sole plate **336** is shown positioned within the pocket **342** in the top of the midsole member **332**. The cushion layer **352** is also positioned within the pocket **342** of the midsole member **332** and on top of the sole plate **336** (e.g., so that the sole plate **336** is embedded in the sole structure **304**, with the cushion layer **352** positioned generally above the midsole member **332**). Accordingly, the sole plate **336** is positioned between the midsole member **332** and the cushion layer **352**. Put another way, the cushion layer **352** is positioned generally above the midsole member **352** and the sole plate **336** so that the cushion layer **352** is between the upper **302** and each of the midsole member **352** and the sole plate **336**. Further, the midsole member **332** extends from the medial side **316** to the lateral side **318** and the outsole **330** extends across the bottom of the midsole member **332**. Looking at FIGS. **6**A, **6**C, and **6**D, and as mentioned above, this portion of the sole structure **304** is located underneath the ball of a user's foot (shown in FIG. **4**) and creates a rocking member (i.e., a rocking region) with a fulcrum proximate to the metatarsal bones of the user. The position of the sole plate **336** in relationship to the midsole member **332** effectively adjusts the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In FIG. **6**G, the sole plate **336** is also shown positioned within the pocket **342** of the midsole member **332** and exposed through the cutout portion **338**. The cushion layer **352** is also positioned within the pocket **342** and on top of the sole plate **336**. Along the medial side **316**, the midsole member **332** is spaced from the ground surface **324** and is configured to be capable of engaging an elevated ground surface or other external surface at the midfoot region **310**.

Further, FIGS. **6**J and **6**K show cross-sectional views of the heel region **312** along lines **6**J-**6**J and **6**K-**6**K of FIG. **6**B. In FIG. **6**J, the sole plate **336** is shown positioned within the pocket **342** of the midsole member **332** and exposed through the cutout portion **338**. The pocket **342** and the sole plate **336** are correspondingly shaped such that a peripheral envelope of the pocket **342** bounds and can be in contact with an outer periphery of the sole plate **336**. As such, the pocket **342** can be shaped to receive the sole plate **336**, and the sole plate **336** can be shaped to be received within the pocket **336**.

Additionally, the cushion layer **352** is also positioned within the pocket **342** and on top of the sole plate **336**. Accordingly, the sole plate **336** can be contained in the pocket **342** by the cushion layer **352**. Further, the midsole member **332** on the medial side **316** is spaced from the ground surface, but less spaced than in the part of the midfoot region **310** shown in FIG. **6**I. In FIG. **6**K, the sole plate **336** is shown positioned within the pocket **342** of the midsole member **332**. Additionally, the cushion layer **352** is also positioned within the pocket **342** and on top of the sole plate **336**. Further, the midsole member **332** extends continuously from the medial side **316** to the lateral side **318**.

FIGS. **6**L and **6**G illustrate a toe view and a heel view, respectively, of the article of footwear **300**. The outsole **330** extends up and around the midsole member **332** and at least a portion of the upper **302** in the front of the forefoot region **308** (shown in FIGS. **6**A, **6**C and **6**D).

FIGS. **7**A through **7**M illustrate another embodiment of an article of footwear **400** according to the invention. In many aspects, the article of footwear **400** is similar to the article of footwear **200** described above and similar numbering in the **400** series is used for the article of footwear **400**. For example, the article of footwear **400** has an upper **402**, a sole structure **404**, an interior cavity **406** defined by the combination of the upper **402** and the sole structure **404**, a forefoot region **408**, a midfoot region **410**, a heel region **412**, a medial side **416**, and a lateral side **418**. Further, the sole structure **404** has an outsole **430**, a first midsole member **432** (e.g., a first cushion layer), a second midsole member **434** (e.g., a second cushion layer) with a pocket **442**, a sole plate **436**, an arched section **440**, and a cutout portion **438**. The first midsole member **432**, the second midsole member **434**, and the sole plate **436** can form a cushioning system of the sole structure **404** (e.g., a midsole of the sole structure **404**). Additionally, the sole structure **404** is shaped to define an entry angle **420** in the heel region **412** and an exit angle **422** in the forefoot region **408** with respect to a flat ground surface **424**. Similarly, in some embodiments, the entry angle **420** can be about 30 degrees and the sole structure **404** can start angling away from the ground surface **424** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **422** can be about 15 degrees and can start angling away from the ground surface **424** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Additionally, the first midsole member **432**, the second midsole member **434**, and the sole plate **436** can be similarly constructed as the first midsole member **232**, the second midsole member **234**, and the sole plate **236**. For example, the first and second midsole members **432**, **434** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, ethylene-vinyl acetate (EVA) polymer, copolymers thereof, or a similar type of material and the sole plate **436** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof.

In some aspects, however, the articles of footwear **200**, **400** differ from each other. For example, the sole plate **436** has a shape that is similar to but proportionally smaller than the midsole member **432** throughout the forefoot, midfoot, and heel regions **408**, **410**, **412** (shown in FIG. **7**E).

Additionally, as shown in FIG. **7**D and FIGS. **7**G, **7**I, and **7**J, which are cross-sectional views taken along lines **7**G-**7**G, **7**I-**7**I, and **7**J-**7**J in FIG. **7**B within the forefoot region **408**, the midfoot region **410**, and the heel region **412**, respectively, the first midsole member **432** and the second midsole member **434** are positioned differently within the sole structure **404** than the first midsole member **232** and the second midsole member **234** in the sole structure **204**. For example, the second midsole member **434** extends around the front of the first midsole member **432** in the forefoot region **408** (shown in FIG. **7**D).

FIGS. **8**A through **8**M illustrate another embodiment of an article of footwear **500** according to the invention. In many aspects, the article of footwear **500** is similar to the article of footwear **300** described above and similar numbering in the **500** series is used for the article of footwear **500**. For example, the article of footwear **500** has an upper **502**, a sole structure **504**, an interior cavity **506** defined by the combination of the upper **502** and the sole structure **504**, a forefoot region **508**, a midfoot region **510**, a heel region **512**, a medial side **516**, and a lateral side **518**. Further, the sole structure **504** has an outsole **530**, a midsole member **532** (i.e., a first midsole member or cushion layer of a midsole) with a pocket **542**, a sole plate **536**, a cushion layer **552** (i.e., a second midsole member or cushion layer of a midsole), an arched section **540**, and a cutout portion **538**. The sole plate **536** is disposed between the midsole member **532** and the cushion layer **552** and the cushion layer **552** is positioned between the upper **502** and each of the midsole member **532** and the sole plate **536**. The sole plate **536** extends at least partially through the midfoot region **510** and is exposed at the cutout portion **538** of the midsole member **532**. The midsole member **532**, the cushion layer **552**, and the sole plate **536** can form a cushioning system of the sole structure **504** (e.g., a midsole of the sole structure **504**). Additionally, the sole structure **504** is shaped to define an entry angle **520** in the heel region **512** and an exit angle **522** in the forefoot region **508** with respect to a flat ground surface **524**. Similarly, in some embodiments, the entry angle **520** can be about 30 degrees and the sole structure **504** can start angling away from the ground surface **524** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **522** can be about 15 degrees and can start angling away from the ground surface **524** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Accordingly, when in a rested state as shown in FIGS. **8**A-**8**M, the sole structure **504** is shaped to define an entry angle **520** in the heel region **512** and an exit angle **522** in the forefoot region **508** with respect to a flat ground surface **524**. The sole structure **504** can also define a substantially flat region **519** that is approximately parallel with the flat ground surface **524**. The substantially flat region **519** can extend from a first end **560** to a second end **562**. As illustrated in FIGS. **8**A, **8**C, and **8**D, the first end **560** can be in the heel region **512** and the second end **562** can be in the forefoot region **508**.

Correspondingly, the sole structure **504** can define an entry region **521** in which a bottom surface **505** (e.g., a ground engaging surface) of the sole structure **504** curves upwardly to start angling away from the ground surface **524** approximate the area underneath the heel of a user's foot (shown in FIG. **4**) by at least the entry angle **520**. In that regard, the entry region **521** can include an angled portion **557** (e.g., an angled region). The angled portion **557** extends from a first end **564** to a second end **566**. The first end **564** is positioned proximate the substantially flat region **519** such that the first end **564** is positioned below a heel end **568** of the sole plate **536** and such that the first end **564** is closer to the forefoot region **508** than is the heel end **568** of the sole plate **536**. The second end **566** is positioned above the heel

end **568** of the sole plate **536** and the second end **566** is positioned farther from the forefoot region **508** than is the heel end **568** of the sole plate **536**. The angled portion **557** is substantially flat between the first end **564** and the second end **566**. For example, between the first end **564** and the second end **566**, the angle portion **557**, and thus the entry region **521**, can be at about the entry angle **520** to enhance contact with a user's heel during a heel strike. In that regard, the angled portion **557** forms a portion of the bottom surface **505** of the sole structure **504** that is configured to engage the ground during a heel strike. In some cases, the second end **566** of the angled portion **557**, and thus the entry region **521**, defines a heel end **570** of the bottom surface **505**. Accordingly, the ground-engaging bottom surface **505** extends above the heel end **570** of the sole plate **536**.

Correspondingly, the sole structure **504** can also define an exit region **523** in which the bottom surface **505** of the sole structure **504** curves upwardly to start angling away from the ground surface **524** approximate the area underneath the balls of a user's foot (shown in FIG. **4**) by at least the exit angle **524**. In that regard, the exit region **523** can include an angled portion **559** (e.g., an angled region). The angled portion **559** extends from a first end **574** to a second end **576**. The first end **574** is positioned proximate the substantially flat region **519** such that the first end **574** is positioned below a toe end **578** of the sole plate **536** and such that the first end **574** is closer to the heel region **512** than is the toe end **578** of the sole plate **536**. The angled portion **559** is substantially flat between the first end **574** and the second end **576**. For example, between the first end **574** and the second end **576** the angled portion **559**, and thus the exit region **523**, can be at about the exit angle **522** to adjust the running posture of the user to be a forward tilt to move the running motion of the user toward their forefoot to propel the user forward. In that regard the angled portion **559** forms a portion of the bottom surface **505** of the sole structure **504** that is configured to engage the ground during toe-off. In some cases, the second end **576** of the angled portion **559**, and thus the exit region **523**, defines a toe end **580** of the bottom surface **505**.

The entry and exit angles **520**, **524** can be configured to enhance contact with a user's heel during a heel strike and promoting engagement of a large surface area of the outsole **530** in the forefoot region **508** during a push-off by the user. Accordingly, the entry region **521** can extend rearward from the substantially flat region **519** and the exit region **523** can extend forward from the substantially flat region **519**. In some embodiments, the junction between the substantially flat region **519** and the exit region **523** can be located at a widest portion **507** of the sole structure **504** (e.g., at a greatest distance between the medial and lateral sides **516**, **518**), so as to be aligned proximate to the metatarsal bones of the user.

Due to the curved nature of each of the entry region **521** and the exit region **523**, the respective junctions with the substantially flat region **519** can form rocking regions **525**, **527** (e.g., rocking members). The rocking regions **525**, **527** are formed as convex regions of the bottom surface **505** that can create a fulcrum for the sole plate **536**. For example, the fulcrum created by the rocking region **525** can create a propulsion lever with the sole plate **536** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward. More specifically, the fulcrum created by the rocking region **525** can create a propulsion lever with the sole plate **536** between the entry region **521** and the substantially flat region **519**. The rocking region **525** is an entirely convex region that extends between the first end **560** of the substantially flat region **519** and the first end **564** of the substantially flat angled portion **557**. The entry region **521** includes the rocking region **525** and the angled portion **557**, such that the entry region **521** curves upwardly from the substantially flat region **519** at the rocking region **525** to form the angled portion **557**. In that regard, the rocking region **525** forms an upwardly curved portion (e.g., an upwardly curved entry region). The fulcrum created by the rocking region **527** can also act as a propulsion level with the sole plate **536** proximate to the metatarsal bones of the user by adjusting the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot. The fulcrum created by the rocking region **527** can create a propulsion lever with the sole plate **536** between the exit region **523** and the substantially flat region **519**. The rocking region **527** is an entirely convex region that extends between the second end **562** of the substantially flat region **519** and the first end **574** of the substantially flat angled portion **559**. The exit region **523** includes the rocking region **527** and the angled portion **559**, such that the exit region **523** curves upwardly from the substantially flat region **519** at the rocking region **527** to form the angled portion **559**. In that regard, the rocking region **527** forms an upwardly curved portion (e.g., an upwardly curved exit region).

Additionally, the midsole member **532**, the sole plate **536**, and the cushion layer **552** can be similarly constructed as the midsole member **332**, the sole plate **336**, and the cushion layer **352**. For example, the midsole member **532** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material; the sole plate **536** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof; and the cushion layer **552** can be formed from a thermoplastic elastomer material, for example, a polyether block amide (PEBA), including PEBAX® foam. In some embodiments, the cushion layer member **552** can be constructed from an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam.

Another similarity is that the sole plate **536** has a shape that is similar to but proportionally smaller than the midsole member **532** throughout the forefoot, midfoot, and heel regions **508**, **510**, **512** (shown in FIG. **8E**). Additionally, the pocket **542** and the sole plate **536** are correspondingly shaped such that a peripheral envelope of the pocket **542** bounds and can be in contact with an outer periphery of the sole plate **536**. Put another way, the pocket **542** can be shaped to receive the sole plate **536**, and the sole plate **536** can be shaped to be received in the pocket **542**. Further, the cushion layer **552** can also be positioned within the pocket **542**, such that the sole plate **536** can be secured in the pocket **542** by the cushion layer **352**. In particular, the sole plate **536** can be secured between the midsole member **532** and the cushion layer **552**, with the midsole member **532** in contact with a first side of the sole plate **536** and the cushion layer **552** in contact with a second side of the sole plate **536** that is opposite the first side. It is appreciated that the cushioning layer **552** can be coupled to the midsole member **532**. Moreover, the position of the sole plate **536** in relation to the first midsole member **532** and the cushion layer **552** can

effectively adjust the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In some aspects, however, the articles of footwear **300**, **500** differ from each other. For example, the cushion layer is different. As shown in FIGS. **8**D and **8**G, which is a cross-sectional view taken along line **8**G-**8**G in FIG. **8**B within the forefoot region **508**, the cushion layer **552** extends into the forefoot region **508**.

Further, in some embodiments, the ground-engaging surface is not continuous along the medial side **516** of the midfoot region **510** of the article of footwear. Correspondingly, the outsole **530** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **8**B, the outsole **530** includes a first outsole portion **530***a* positioned in the forefoot region **508** and generally forward of the widest portion **507** (e.g., to extend into the exit region **523**). Additionally, the outsole **530** includes a second outsole portion **530***b* extending from the widest portion **507** and along the lateral side **518** of the midfoot region **410** to the heel region **512**. Further, the outsole **530** can include a third outsole portion **530***c* that is coupled to the medial side **516** of the first midsole member in the heel region **512** (e.g., to extend into the entry region **521**).

In some embodiments, for example, as illustrated in FIGS. **8**B, and **8**I-**8**M, the first midsole member **532** can define a longitudinal channel **533** that extends from the heel region **512** and into the midfoot region **510**. As illustrated, the second and third outsole portions **530***b*, **530***c* are positioned on opposite sides of the longitudinal channel **533** so that the ground engaging surface is not continuous between the medial and lateral sides **516**, **518** in the heel region **512**.

FIGS. **9**A through **9**M illustrate another embodiment of an article of footwear **600** according to the invention. In many aspects, the article of footwear **600** is similar to the article of footwear **500** described above and similar numbering in the **600** series is used for the article of footwear **600**. For example, the article of footwear **600** has an upper **602**, a sole structure **604**, an interior cavity **606** defined by the combination of the upper **602** and the sole structure **604**, a forefoot region **608**, a midfoot region **610**, a heel region **612**, a medial side **616**, and a lateral side **618**. Further, the sole structure **604** has an outsole **630**, a midsole member **632** (e.g., a first midsole member or cushion layer of a midsole) with a pocket **642**, a sole plate **636**, a cushion layer **652** (e.g., a second midsole member or cushion layer of a midsole), an arched section **640**, and a cutout portion **638**. The sole plate **636** is disposed between the midsole member **632** and the cushion layer **652**. The sole plate **636** extends at least partially through the midfoot region **610** and is exposed at the cutout portion **638** of the midsole member **632**. The cushion layer **652** is positioned between the upper **602** and each of the midsole member **632** and the sole plate **636**. The midsole member **632**, the cushion layer **652**, and the sole plate **636** can form a cushioning system of the sole structure **604** (e.g., a midsole of the sole structure **604**). Additionally, the sole structure **604** is shaped to define an entry angle **620** in the heel region **612** and an exit angle **622** in the forefoot region **608** with respect to a flat ground surface **624**. Similarly, in some embodiments, the entry angle **620** can be about 30 degrees and the sole structure **604** can start angling away from the ground surface **624** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **622** can be about 15 degrees and can start angling away from the ground

surface **624** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Accordingly, when in a rested state as shown in FIGS. **9**A-**9**M, the sole structure **604** is shaped to define an entry angle **620** in the heel region **612** and an exit angle **622** in the forefoot region **608** with respect to a flat ground surface **624**. The sole structure **604** can also define a substantially flat region **619** that is approximately parallel with the flat ground surface **624**. The substantially flat region **619** can extend from a first end **660** to a second end **662**. As illustrated in FIGS. **8**A, **8**C, and **8**D, the first end **660** can be in the heel region **612** and the second end **662** can be in the forefoot region **608**.

Correspondingly, the sole structure **604** can define an entry region **621** in which a bottom surface **605** (e.g., a ground engaging surface) of the sole structure **604** curves upwardly to start angling away from the ground surface **624** approximate the area underneath the heel of a user's foot (shown in FIG. **4**) by at least the entry angle **620**. In that regard, the entry region **621** can include an angled portion **567** (e.g., an angled region). The angled portion **657** extends from a first end **664** to a second end **666**. The first end **664** is positioned proximate the substantially flat region **619** such that the first end **664** is positioned below a heel end **668** of the sole plate **636** and such that the first end **664** is closer to the forefoot region **608** than is the heel end **668** of the sole plate **636**. The second end **666** is positioned above the heel end **668** of the sole plate **636** and the second end **666** is positioned farther from the forefoot region **608** than is the heel end **668** of the sole plate **636**. The angled portion **657** is substantially flat between the first end **664** and the second end **666**. For example, between the first end **664** and the second end **666**, the angled portion **657**, and thus the entry region **621**, can be at about the entry angle **620** to enhance contact with a user's heel during a heel strike. In that regard, the angled portion **657** forms a portion of the bottom surface **605** of the sole structure **604** that is configured to engage the ground during a heel strike. In some cases, the second end **666** of the angled portion **657**, and thus the entry region **621**, defines a heel end **670** of the bottom surface **605**. Accordingly, the ground-engaging bottom surface **605** extends above the heel end **670** of the sole plate **636**.

Correspondingly, the sole structure **604** can also define an exit region **623** in which the bottom surface **605** of the sole structure **604** curves upwardly to start angling away from the ground surface **624** approximate the area underneath the balls of a user's foot (shown in FIG. **4**) by at least the exit angle **624**. In that regard, the exit region **623** can include an angled portion **659** (e.g., an angled region). The angled portion **659** extends from a first end **674** to a second end **676**. The first end **674** is positioned proximate the substantially flat region **619** such that the first end **674** is positioned below a toe end **678** of the sole plate **636** and such that the first end **674** is closer to the heel region **612** than is the toe end **678** of the sole plate **636**. The second end **676** is positioned above the toe end **678** of the sole plate **636** and the second end **676** is positioned farther from the heel region **612** than is the toe end **678** of the sole plate **636**. The angled portion **659** is substantially flat between the first end **674** and the second end **676**. For example, between the first end **674** and the second end **676**, the angled portion **659**, and thus the exit region **623**, can be at about the exit angle **622** to adjust the running posture of the user to be a forward tilt to move the running motion of the user toward their forefoot to propel the user forward. In that regard the angled portion **659** forms a portion of the bottom surface **605** of the sole structure **604** that is configured to engage the ground during toe-off. In

some cases, the second end **676** of the angled portion **659**, and thus the exit region **623**, defines a toe end **680** of the bottom surface **605**.

The entry and exit angles **620**, **624** can be configured to enhance contact with a user's heel during a heel strike and promoting engagement of a large surface area of the outsole **630** in the forefoot region **608** during a push-off by the user. Accordingly, the entry region **621** can extend rearward from the substantially flat region **619** and the exit region **623** can extend forward from the substantially flat region **619**. In some embodiments, the junction between the substantially flat region **619** and the exit region **623** can be located at a widest portion **607** of the sole structure **604** (e.g., at a greatest distance between the medial and lateral sides **616**, **618**), so as to be aligned proximate to the metatarsal bones of the user.

Due to the curved nature of each of the entry region **621** and the exit region **623**, the respective junctions with the substantially flat region **619** can form rocking regions **625**, **627** (e.g., rocking members). The rocking regions **625**, **627** are formed as convex regions of the bottom surface **505** that can create a fulcrum for the sole plate **636**. For example, the fulcrum formed by the rocking region **625** can create a propulsion lever with the sole plate **636** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward. More specifically, the fulcrum created by the rocking region **625** can create a propulsion lever with the sole plate **636** between the entry region **621** and the substantially flat region **619**. The rocking region **625** is an entirely convex region that extends between the first end **660** of the substantially flat region **619** and the first end **664** of the substantially flat angled portion **657**. The entry region **621** includes the rocking region **625** and the angled portion **657**, such that the entry region **621** curves upwardly from the substantially flat region **619** at the rocking region **625** to form the angled portion **657**. In that regard, the rocking region **625** forms an upwardly curved portion (e.g., an upwardly curved entry region). The fulcrum formed by the rocking region **627** can also act as a propulsion level with the sole plate **636** proximate to the metatarsal bones of the user by adjusting the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot. The fulcrum created by the rocking region **627** can create a propulsion lever with the sole plate **636** between the exit region **623** and the substantially flat region **619** (e.g., proximate the widest portion **607** of the sole structure **604**). The rocking region **627** is an entirely convex region that extends between the second end **662** of the substantially flat region **619** and the first end **674** of the substantially flat angled portion **659**. The exit region **623** includes the rocking region **627** and the angled portion **659**, such that the exit region **623** curves upwardly from the substantially flat region **619** at the rocking region **627** to form the angled portion **659**. In that regard, the rocking region **627** forms an upwardly curved portion (e.g., an upwardly curved exit region).

Additionally, the midsole member **632**, the sole plate **636**, and the cushion layer **652** can be similarly constructed as the midsole member **532**, the sole plate **536**, and the cushion layer **552**. For example, the midsole member **632** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material; the sole plate **636** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof; and the cushion layer **652** can be formed from a thermoplastic elastomer material, for example, a polyether block amide (PEBA), including PEBAX® foam.

Further, the sole plate **636** has a shape that is similar to but proportionally smaller than the midsole member **632** throughout the forefoot, midfoot, and heel regions **608**, **610**, **612** (shown in FIG. 9E). Additionally, the pocket **642** and the sole plate **636** are correspondingly shaped such that a peripheral envelope of the pocket **642** bounds and can be in contact with an outer periphery of the sole plate **636**. Put another way, the pocket **642** can be shaped to receive the sole plate **636**, and the sole plate **636** can be shaped to be received within the pocket **642**. Further, the cushion layer **652** can also be positioned within the pocket **642**, such that the sole plate **636** can be secured in the pocket **642** by the cushion layer **352**. In particular, the sole plate **636** can be secured between the midsole member **632** and the cushion layer **652**, with the midsole member **632** in contact with a first side of the sole plate **636** and the cushion layer **652** in contact with a second side of the sole plate **636** that is opposite the first side. The cushion layer **652** may extend to cover the entirety of the second side of the sole plate **636**. It is appreciated that the cushioning layer **652** can be coupled to the midsole member **632**. Moreover, the position of the sole plate **636** in relation to the first midsole member **632** and the cushion layer **652** can effectively adjust the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In some embodiments, the ground-engaging surface is not continuous along the medial side **616** of the midfoot region **610** of the article of footwear. Correspondingly, the outsole **630** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. 8B, the outsole **630** includes a first outsole portion **630***a* positioned in the forefoot region **608** and generally forward of the widest portion **607** (e.g., to extend into the exit region **623**). Additionally, the outsole **630** includes a second outsole portion **630***b* extending from the widest portion **607** and along the lateral side **618** of the midfoot region **410** to the heel region **612**. Further, the outsole **630** can include a third outsole portion **630***c* that is coupled to the medial side **616** of the first midsole member in the heel region **612** (e.g., to extend into the entry region **621**).

In some aspects, however, the articles of footwear **500**, **600** differ from each other. For example, as shown in FIGS. 9D, 9E and FIG. 9F, which is a cross-sectional view taken along line 9F-9F in FIG. 9B within the forefoot region **608**, the cushion layer **652** extends even farther into the forefoot region **608**. Further, as shown in FIGS. 9D-9M, the cushion layer **652** can be configured to cover the entirety of the second side of the sole plate **636** when the sole plate **636** and the cushion layer **652** are received within the pocket **642**. Additionally, the midsole member **632** has a more consistent thickness from the midfoot region **610** through the forefoot region **608** and is thinner than the midsole member **532** near the midfoot region **610** and thicker in the portion beneath a user's toes in the forefoot region **608**. The midsole member **632** also has a chamber **654** extending upward into the midsole member **632** and extending from the forefoot region **608** into the cutout portion **638**. In some embodiments, the chamber **654** can be arch-shaped. Looking at FIGS. 9F-9H, in those embodiments, the height of the chamber **654** (defined as measured from the ground surface **624** to the top of the chamber **654** taken along the shortest path) can be

about half the thickness of the midsole member **632** (defined as measured from the top of the chamber **654** to the top of the midsole member **632** taken along the shortest path). In some embodiments, the width of the chamber **654** can decrease moving from the forefoot region **608** to the cutout portion **638**. In some embodiments the area of the cross-section of the chamber **654** can remain constant moving from the forefoot region **608** to the cutout portion **638** (e.g., as the width of the chamber **654** decreases, the height of the chamber **654** increases).

FIGS. **10**A through **10**M illustrate another embodiment of an article of footwear **700** according to the invention. In many aspects, the article of footwear **700** is similar to the article of footwear **300** described above and similar numbering in the **700** series is used for the article of footwear **700**. For example, the article of footwear **700** has an upper **702**, a sole structure **704**, an interior cavity **706** defined by the combination of the upper **702** and the sole structure **704**, a forefoot region **708**, a midfoot region **710**, a heel region **712**, a medial side **716**, and a lateral side **718**. Further, the sole structure **704** has an outsole **730**, a midsole member **732** (e.g., a first midsole member or cushion layer) with a pocket **742**, a sole plate **736**, a cushion layer **752** (e.g., a second midsole member or cushion layer), an arched section **740**, and a cutout portion **738**. The midsole member **732**, the cushion layer **752**, and the sole plate **736** can form a cushioning system of the sole structure **704** (e.g., a midsole of the sole structure **704**). Additionally, the sole structure **704** is shaped to define an entry angle **720** in the heel region **712** and an exit angle **722** in the forefoot region **708** with respect to a flat ground surface **724**. Similarly, in some embodiments, the entry angle **720** can be about 30 degrees and the sole structure **704** can start angling away from the ground surface **724** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **722** can be about 15 degrees and can start angling away from the ground surface **724** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Additionally, the midsole member **732**, the sole plate **736**, and the cushion layer **752** can be similarly constructed as the midsole member **332**, the sole plate **336**, and the cushion layer **352**. For example, the midsole member **732** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material; the sole plate **736** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof; and the cushion layer **752** can be formed from a thermoplastic elastomer material, for example, a polyether block amide (PEBA), including PEBAX® foam.

Another similarity is that the sole plate **736** has a shape that is similar to but proportionally smaller than the midsole member **732** throughout the forefoot, midfoot, and heel regions **708**, **710**, **712** (shown in FIG. **10**E). Additionally, the pocket **742** and the sole plate **736** are correspondingly shaped such that a peripheral envelope of the pocket **742** bounds and can be in contact with an outer periphery of the sole plate **736**. Put another way, the pocket **742** can be shaped to receive the sole plate **736**, and the sole plate **736** can be shaped to be received in the pocket **742**. Further, the cushion layer **752** can also be positioned within the pocket **742**, such that the sole plate **736** can be secured in the pocket **742** by the cushion layer **352**. In particular, the sole plate **736** can be secured between the midsole member **732** and the cushion layer **752**, with the midsole member **732** in contact with a first side of the sole plate **736** and the cushion layer **752** in contact with a second side of the sole plate **736** that is opposite the first side. It is appreciated that the cushioning layer **752** can be coupled to the midsole member **732**. Moreover, the position of the sole plate **736** in relation to the first midsole member **732** and the cushion layer **752** can effectively adjust the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In some aspects, however, the articles of footwear **300**, **700** differ from each other. For example, the cushion layer is different. As shown in FIGS. **10**D and **10**F, which is a cross-sectional view taken along line **10**G-**10**G in FIG. **10**B within the forefoot region **708**, the cushion layer **752** extends into the forefoot region **708**.

The above-described sole plates, such as sole plates **136**, **236**, **336**, **436**, **536**, **636**, and **736** provide a rigid sole that can promote a faster takeoff when running. In particular, the fulcrum of the rocking member creates a propulsion lever between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward. Further, embodiments of the sole structures described herein can provide a training aid or tool that can be used to strengthen entire leg and foot muscles of a wearer and adjust their running posture to a forward-tilt position that promotes constant muscle tension.

Any of the embodiments described herein may be modified to include any of the structures or methodologies disclosed in connection with different embodiments. Further, the present disclosure is not limited to articles of footwear of the type specifically shown. Still further, aspects of the articles of footwear of any of the embodiments disclosed herein may be modified to work with any type of footwear, apparel, or other athletic equipment.

As noted previously, it will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

INDUSTRIAL APPLICABILITY

Numerous modifications to the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the invention and to teach the best mode of carrying out same. The exclusive rights to all modifications which come within the scope of the appended claims are reserved.

We claim:

1. A sole structure for an article of footwear having an upper, the sole structure comprising:

an outsole;

a midsole member disposed between the outsole and the upper, the midsole member having a pocket extending from a heel region to a forefoot region; and

a sole plate extending from the heel region into the forefoot region,

wherein, in the heel region, the sole structure is shaped to define an entry region that is configured to increase contact at a ground engaging surface of the sole structure during a heel strike, the entry region curving upward to form an angled portion that is substantially flat between a first end and a second end so that the angled portion is angled at an entry angle relative to a flat ground surface, and

wherein the first end of the angled portion is below a heel end of the sole plate and the second end of the angled portion is above the heel end of the sole plate to define a heel end of the ground engaging surface that is above the heel end of the sole plate.

2. The sole structure of claim **1**, wherein the midsole member includes a first midsole member and a second midsole member disposed between the first midsole member and the upper.

3. The sole structure of claim **2**, wherein the second midsole member is positioned on top of the sole plate so that the sole plate is positioned between the first midsole member and the second midsole member.

4. The sole structure of claim **1**, wherein the sole plate is a carbon fiber plate that is similarly shaped to and proportionally smaller than the midsole member in at least one of the forefoot region, a midfoot region, or the heel region of the sole structure.

5. The sole structure of claim **1**, wherein the midsole member defines a longitudinal channel extending from a heel end of the sole structure and into a midfoot region.

6. The sole structure of claim **5**, wherein the outsole includes a first outsole member and a second outsole member that are separated from one another by the longitudinal channel so that the ground engaging surface is not continuous across the heel region between a lateral side and medial side of the sole structure.

7. The sole structure of claim **1**, wherein the outsole includes a first outsole member in the forefoot region and a second outsole member in the heel region, and

wherein the ground engaging surface is not continuous along a medial side of a midfoot region of the sole structure.

8. The sole structure of claim **1**, wherein the first end of the angled portion is closer to the forefoot region than is the heel end of the sole plate and the second end of the angled portion is farther from the forefoot region than is the heel end of the sole plate.

9. The sole structure of claim **1**, wherein the outsole extends onto the angled portion.

10. The sole structure of claim **1**, wherein the entry region includes a first rocking region that extends from a substantially flat region to the angled portion, the first rocking region being entirely convex between the substantially flat region and the angled portion.

11. The sole structure of claim **10**, wherein, in the forefoot region, the sole structure is shaped to define an exit region that curves to angle away from the flat ground surface, and

wherein the exit region includes a second rocking region that forms a fulcrum proximate a widest portion of the sole structure, the second rocking region forming a propulsion lever with the sole plate that is configured to propel a user forward during toe off.

12. The sole structure of claim **11**, wherein the angled portion of the entry region is a first angled portion and the exit region includes a second angled portion extending from a third end positioned at the second rocking region to a fourth end that corresponds with a toe end of the ground engaging surface, the second angled portion being substantially flat between the third end and the fourth end so that the second angled portion is angled at an exit angle relative to a flat ground surface.

13. The sole structure of claim **12**, wherein the entry angle is thirty degrees and the exit angle is fifteen degrees.

14. A sole structure for an article of footwear having an upper, the sole structure comprising:

an outsole;

a midsole extending between the outsole and the upper, the midsole including:

a first midsole member coupled to the outsole and extending from a forefoot region to a heel region of the sole structure, the first midsole member defining an entry region at a heel end in which the first midsole member defines a substantially flat angled portion that is angled away from a ground surface by a first angle that is configured to increase contact at a ground engaging surface of the first midsole member during a heel strike, and

a second midsole member coupled to the upper and positioned between the first midsole member and the upper, the second midsole member extending from the heel region to the forefoot region; and

a sole plate positioned within the midsole between the first midsole member and the second midsole member, the sole plate being exposed at a cutout portion in the first midsole member,

wherein the substantially flat angled portion of the entry region extends from a first end to a second end, the first end being positioned below a heel end of the sole plate and the second end being positioned above the heel end of the sole plate.

15. The sole structure of claim **14**, wherein the sole plate is comprised of carbon fibers and extends from the heel region to the forefoot region.

16. The sole structure of claim **14**, wherein the outsole extends at least partially into the entry region.

17. The sole structure of claim **14**, wherein the first midsole member further defines an exit region in the forefoot region in which the first midsole member curves away from the ground surface from approximately a widest portion of the sole structure to extend to a toe end of the sole structure.

18. The sole structure of claim **17**, wherein the first midsole member defines a substantially flat region between the entry region and the exit region.

19. The sole structure of claim **18**, wherein the exit region includes a rocking region that extends from the substantially flat region, the rocking region creating a fulcrum for the sole plate to help propel a user forward during toe off.

20. The sole structure of claim **19**, wherein the fulcrum is positioned to be proximate metatarsal bones of a user.

21. The sole structure of claim **14**, wherein the first midsole member defines a pocket and at least one of the sole plate or the second midsole member is disposed at least partially within the pocket.

22. A sole structure for an article of footwear having an upper, the sole structure comprising:

a first midsole member extending from a forefoot region to a heel region of the sole structure, the first midsole member defining an entry region in a heel region that is configured to increase contact with a ground surface during a heel strike, an exit region in a forefoot region, and a substantially flat region extending between the entry region and the exit region;

an upwardly curved entry region along the bottom surface in the heel region,

a second midsole member positioned between the first midsole member and the upper, the second midsole member extending from the heel region to the forefoot region; and

a sole plate positioned between the first midsole member and the second midsole member, the sole plate including a heel end that is disposed in the heel region, and the sole plate being exposed at a cutout portion in the first midsole member,

wherein the entry region includes an angled portion and a first rocking region, the first rocking region extending between the substantially flat region and the angled portion, the angled portion extending from a first end that is positioned at the first rocking region and below the heel end of the sole plate to a second end that is positioned above the heel end of the sole plate, and the angled portion being substantially flat between the first end and the second end to define an entry angle relative to the substantially flat region, and

wherein the exit region is shaped to create a fulcrum for the sole plate to help propel a user forward during toe off.

23. The sole structure of claim **22**, wherein the sole plate defines a first region with a first stiffness and a second region with a second stiffness that is greater than the first stiffness.

24. The sole structure of claim **22**, further including an outsole coupled to the first midsole member, the outsole including a first outsole portion positioned in the forefoot region and a second outsole portion positioned in the heel region, the first outsole portion and the second outsole portion being spaced from one another.

25. The sole structure of claim **22**, wherein the exit region includes a second rocking region that curves upwardly from approximately a widest portion of the sole structure to extend to a toe end of the sole structure.

* * * * *

EXHIBIT E

US0D1022421S

(12) **United States Design Patent** (10) **Patent No.: US D1,022,421 S**
Redon (45) **Date of Patent: ** Apr. 16, 2024**

(54) **SHOE**

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(**) Term: **15 Years**

(21) Appl. No.: **29/891,188**

(22) Filed: **May 2, 2023**

Related U.S. Application Data

(63) Continuation of application No. 29/797,495, filed on Jun. 30, 2021.

(51) **LOC (14) Cl.** **02-04**

(52) **U.S. Cl.**
USPC **D2/947**; D2/962; D2/954; D2/959; D2/906

(58) **Field of Classification Search**
USPC D2/902, 906, 908, 916, 918, 925, D2/946–962, 972, 977
CPC A43B 13/00; A43B 13/02; A43B 13/023; A43B 13/026; A43B 13/04; A43B 13/08; A43B 13/10; A43B 13/12; A43B 13/14; A43B 13/20; A43B 13/24; A43B 13/28; A43B 13/30; A43B 13/32; A43B 13/34; A43B 13/36; A43B 13/181; A43B 13/187; A43B 13/189; A43B 13/223
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

324,065	A	8/1885	Andrews
413,693	A	10/1889	Walker
634,588	A	10/1899	Roche
1,088,328	A	2/1914	Cucinotta et al.
1,827,514	A	10/1931	Golden
D158,403	S	5/1950	Pierce
2,578,591	A	12/1951	Phillips
D208,393	S	8/1967	Onitsuka
3,402,484	A	9/1968	Brutting
D232,200	S	7/1974	Inohara

(Continued)

FOREIGN PATENT DOCUMENTS

CA	38477	S	12/1974
CA	70286	S	3/1992

(Continued)

OTHER PUBLICATIONS

[Adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https://www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/B0119E37WS/ref=cm_cr_arp_d_product_top?ie=UTF8 (Year: 2015).*

(Continued)

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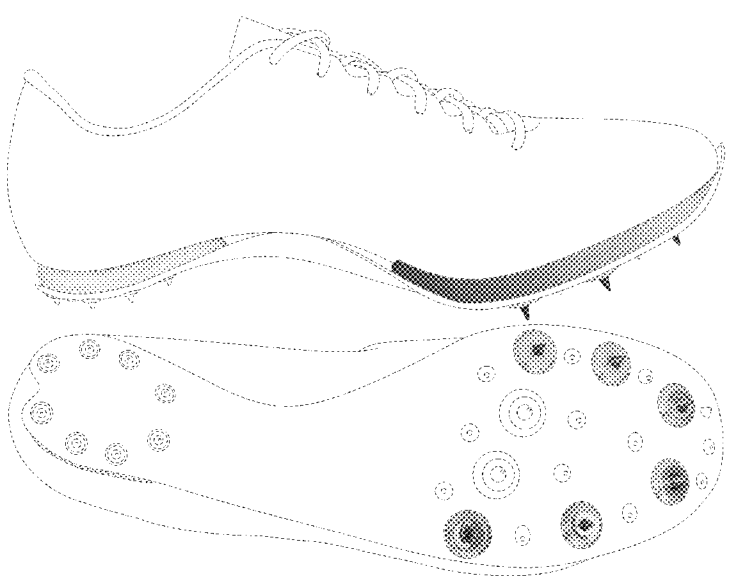
(57) **CLAIM**

The ornamental design for a shoe, as shown and described.

DESCRIPTION

FIG. **1** is a top, right, and front perspective view of an ornamental design for a shoe;
FIG. **2** is a left side elevational view of the shoe of FIG. **1**;
FIG. **3** is a right side elevational view of the shoe of FIG. **1**; and,
FIG. **4** is a bottom plan view of the shoe of FIG. **1**.
The dash-dash-dash broken lines are included for the purpose of illustrating portions of the shoe that form no part of the claimed design. A transition in tonal contrast shown along the front cushion is claimed.

1 Claim, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,020,569	A		5/1977	Fukuoka
4,241,523	A		12/1980	Daswick
4,348,821	A		9/1982	Daswick
4,392,312	A		7/1983	Crowley
4,463,505	A		8/1984	Duclos
4,492,046	A		1/1985	Kosova
4,510,700	A		4/1985	Brown
4,542,598	A		9/1985	Misevich et al.
4,910,884	A		3/1990	Lindh et al.
5,024,007	A		6/1991	DuFour
5,052,130	A		10/1991	Barry et al.
D327,165	S		6/1992	Hatfield
5,138,776	A		8/1992	Levin
5,191,727	A		3/1993	Barry et al.
5,203,095	A		4/1993	Allen
D341,480	S		11/1993	Saito
5,339,544	A	*	8/1994	Caberlotto A43B 23/0255 36/43
D350,638	S		9/1994	Yoshikawa
5,353,523	A		10/1994	Kilgore et al.
5,435,079	A		7/1995	Gallegos
5,461,800	A		10/1995	Luthi et al.
5,528,842	A		6/1996	Ricci et al.
D377,411	S		1/1997	Murray
5,592,757	A		1/1997	Jackinsky
D378,472	S		3/1997	Bramani
5,706,589	A		1/1998	Marc
D396,139	S		7/1998	Dietrich
5,806,209	A		9/1998	Crowley et al.
D401,741	S		12/1998	Clarke
5,875,567	A		3/1999	Bayley
D415,607	S		10/1999	Merceron
6,029,374	A		2/2000	Herr et al.
D423,201	S		4/2000	Wilson
D454,426	S		3/2002	Wilson
6,502,330	B1		1/2003	David et al.
6,505,421	B1		1/2003	Vaz
D473,042	S		4/2003	Wilson
D473,047	S		4/2003	Wilson
D476,800	S		7/2003	Fuerst
6,775,930	B2		8/2004	Fuerst
D498,901	S		11/2004	Hawker
6,826,852	B2		12/2004	Fusco
6,857,205	B1		2/2005	Fusco et al.
D507,398	S		7/2005	Recchi
6,944,972	B2		9/2005	Schmid
D511,617	S		11/2005	Matis
7,013,582	B2		3/2006	Lucas et al.
7,016,867	B2		3/2006	Lyden
7,096,605	B1		8/2006	Kozo et al.
7,100,308	B2		9/2006	Aveni
7,100,309	B2		9/2006	Smith et al.
7,107,235	B2		9/2006	Lyden
7,152,343	B2		12/2006	Whatley
7,219,447	B2		5/2007	LeVert
7,350,320	B2		4/2008	Chandler et al.
7,401,419	B2		7/2008	Lucas et al.
7,401,422	B1		7/2008	Scholz et al.
7,434,337	B2		10/2008	Gibert et al.
7,484,317	B2		2/2009	Kita et al.
7,513,065	B2		4/2009	Kita et al.
7,624,515	B2		12/2009	Kita et al.
7,644,518	B2		1/2010	Chandler et al.
D615,738	S		5/2010	Teteriatnikov
7,707,743	B2		5/2010	Schindler et al.
7,786,193	B2		8/2010	Wilding et al.
7,832,117	B2		11/2010	Auger et al.
7,886,461	B2		2/2011	Sato
7,900,376	B2		3/2011	Rabushka
D637,803	S		5/2011	Alvear
7,950,091	B2		5/2011	Auger et al.
7,987,618	B2		8/2011	Nishiwaki et al.
8,028,442	B2		10/2011	Hodgson
8,074,377	B2		12/2011	Nishiwaki et al.
8,079,160	B2		12/2011	Baucom et al.
8,112,909	B2		2/2012	Kubo et al.
8,122,615	B2		2/2012	Lucas et al.
D666,795	S		9/2012	Shaffer
D672,123	S		12/2012	Williams, Jr.
8,341,856	B2		1/2013	Smith et al.
8,393,028	B2		3/2013	Namkook et al.
D680,308	S		4/2013	Hardman
8,418,379	B2		4/2013	Nishiwaki et al.
D685,166	S		7/2013	Hatfield
D688,037	S	*	8/2013	Dekovic D2/962
D690,088	S		9/2013	Hardman
D692,217	S		10/2013	Fogg
8,567,094	B2		10/2013	Lubart
D694,498	S		12/2013	Carboy
D694,499	S		12/2013	Williams, Jr.
8,613,149	B2		12/2013	Schwirian
8,615,901	B2		12/2013	Caine et al.
D707,428	S	*	6/2014	Seamarks D2/947
8,776,397	B2		7/2014	Borel et al.
D710,579	S		8/2014	Williams, Jr.
D713,625	S		9/2014	Raasch
D713,626	S		9/2014	Raasch
D714,035	S		9/2014	O'Connor
8,850,718	B2		10/2014	Lubart
8,919,015	B2		12/2014	Holt et al.
8,945,449	B2		2/2015	Atwal et al.
8,978,274	B2		3/2015	Auger et al.
8,984,775	B2		3/2015	Dombrow et al.
9,009,988	B2		4/2015	Jacobs et al.
D731,767	S		6/2015	Lan
9,066,559	B2		6/2015	Butler
9,144,265	B2		9/2015	Lubart
9,167,864	B1		10/2015	Piontkowski et al.
D743,153	S		11/2015	Taylor
9,179,733	B2		11/2015	Peyton et al.
9,204,686	B2		12/2015	Baum et al.
9,210,967	B2		12/2015	Gerber
D746,560	S		1/2016	Verfl
D747,083	S		1/2016	Verfl
9,241,533	B2		1/2016	Heard et al.
9,259,050	B2		2/2016	Smith et al.
D756,620	S		5/2016	Boys
9,326,562	B2		5/2016	Weidl et al.
9,339,079	B2		5/2016	Lucas et al.
9,375,048	B2		6/2016	James et al.
D768,969	S		10/2016	Boys
D770,739	S		11/2016	Nethongkome
D770,740	S		11/2016	Teteriatnikov
9,491,983	B2		11/2016	Rushbrook
9,516,916	B2		12/2016	Derrier
9,549,589	B2		1/2017	Auger et al.
D779,175	S		2/2017	Greenhalgh
9,572,394	B2		2/2017	Heard et al.
9,572,398	B2		2/2017	Hurd et al.
D782,790	S		4/2017	Lee
9,615,625	B1		4/2017	Huard et al.
9,661,896	B2		5/2017	Elliott et al.
D789,054	S		6/2017	Shyllon
D790,169	S		6/2017	da Costa Pereira Machado
D790,183	S		6/2017	VanHook
9,668,540	B2		6/2017	Scofield et al.
D791,453	S		7/2017	McMillan
D793,046	S		8/2017	Lee
D795,541	S		8/2017	Henrichot
D796,168	S		9/2017	Shyllon
D796,799	S		9/2017	Shyllon
9,750,306	B2		9/2017	Baum et al.
D798,551	S		10/2017	Shyllon
D798,554	S		10/2017	Swierszczk
D798,555	S		10/2017	Enayah
D798,558	S		10/2017	Pauk
9,775,404	B2		10/2017	Fyden
9,820,528	B2		11/2017	Reinhardt et al.
9,820,529	B2		11/2017	Droege et al.
D810,411	S		2/2018	Klein
9,883,714	B2		2/2018	Cavaliere et al.
9,894,958	B2		2/2018	Cheney et al.
D812,871	S		3/2018	Reyes
D815,816	S		4/2018	Cin

(56) **References Cited**

U.S. PATENT DOCUMENTS

D815,817	S		4/2018	Cin	
D815,818	S		4/2018	Cin	
D815,820	S		4/2018	Cin	
D815,821	S		4/2018	Cin	
D815,822	S		4/2018	Cin	
D815,823	S		4/2018	Cin	
9,930,934	B2		4/2018	Cook et al.	
D816,310	S		5/2018	Cooper	
D816,311	S		5/2018	Cin	
D816,959	S		5/2018	Cin	
D816,960	S		5/2018	Cin	
D817,614	S		5/2018	Cin	
D817,615	S		5/2018	Cin	
D817,616	S		5/2018	Cin	
9,961,959	B2		5/2018	Gerber	
9,968,157	B2		5/2018	Wardlaw et al.	
9,968,160	B2		5/2018	Peyton	
10,010,135	B2		7/2018	Lovell et al.	
10,010,137	B2		7/2018	Foxen	
10,016,919	B2		7/2018	Cook et al.	
10,111,491	B2		10/2018	Tanabe et al.	
10,159,303	B2		12/2018	Wang et al.	
10,165,821	B2		1/2019	Truelsen	
10,165,824	B2		1/2019	Auger et al.	
10,226,097	B2		3/2019	Farris et al.	
10,231,517	B2		3/2019	Baucom et al.	
10,271,614	B2		4/2019	Huard et al.	
D847,478	S		5/2019	Fracassi	
10,299,535	B2		5/2019	Hurd et al.	
10,314,365	B2		6/2019	James et al.	
10,314,367	B2		6/2019	Kilgore et al.	
D853,097	S		7/2019	Cass	
D853,701	S		7/2019	Hong	
10,349,700	B2		7/2019	Amis et al.	
D855,301	S		8/2019	Williams, Jr.	
D862,046	S		10/2019	Page	
10,433,616	B2		10/2019	Takeshita et al.	
10,441,027	B2		10/2019	Bartel et al.	
10,448,701	B2		10/2019	Farris et al.	
10,448,704	B2		10/2019	Dupre et al.	
D870,429	S		12/2019	Becker	
10,512,301	B2		12/2019	Peyton	
10,517,350	B2		12/2019	Orand et al.	
10,517,351	B2		12/2019	Arciuolo	
10,524,536	B2		1/2020	Bunnell et al.	
10,548,368	B2		2/2020	Bartel et al.	
10,595,587	B2		3/2020	Cook et al.	
D882,918	S		5/2020	Kosenick	
10,653,205	B2		5/2020	Orand	
D885,718	S		6/2020	Roulo	
D889,798	S		7/2020	Vella	
10,743,606	B2		8/2020	Bartel et al.	
10,743,607	B2		8/2020	Amis et al.	
10,750,817	B2		8/2020	Barnes et al.	
10,758,001	B2		9/2020	Case et al.	
D912,947	S		3/2021	Boys	
D912,948	S		3/2021	Boys	
D913,655	S		3/2021	Boys	
D913,663	S	*	3/2021	Essilfie-Taylor	D2/947
D913,668	S		3/2021	Boys	
D917,848	S		5/2021	Wehrmeyer	
D922,741	S		6/2021	Boys	
D922,742	S		6/2021	Boys	
D929,097	S		8/2021	Winskowicz	
D938,145	S		12/2021	Rezab	
D940,443	S		1/2022	Papp	
D948,853	S		4/2022	Jenkins	
D950,211	S		5/2022	Tejada Bernard	
D954,417	S	*	6/2022	Bidal	D2/954
D964,717	S	*	9/2022	Mahoney	D2/947
D973,337	S	*	12/2022	Lesecq	D2/962
D976,564	S		1/2023	Klug	
D978,508	S		2/2023	Schneider	
2002/0174567	A1		11/2002	Krafsur et al.	
2003/0208929	A1		11/2003	Lucas et al.	
2003/0233770	A1		12/2003	Foscaro	
2004/0107601	A1		6/2004	Schmid	
2004/0200097	A1	*	10/2004	Boyd	A43B 5/02 36/74
2005/0102858	A1		5/2005	Yen	
2005/0126039	A1		6/2005	LeVert	
2005/0166422	A1		8/2005	Schaeffer et al.	
2005/0262739	A1		12/2005	McDonald	
2006/0196084	A1	*	9/2006	Kos	A43B 1/0081 36/133
2007/0043630	A1		2/2007	Lyden	
2007/0101617	A1		5/2007	Brewer et al.	
2007/0240331	A1		10/2007	Borel	
2007/0266593	A1		11/2007	Schindler et al.	
2007/0271818	A1		11/2007	Rabushka	
2008/0072462	A1		3/2008	Fusco	
2008/0189982	A1		8/2008	Krafsur	
2009/0100718	A1	*	4/2009	Gerber	A43C 15/04 36/67 A
2009/0183393	A1		7/2009	Lee	
2009/0307925	A1		12/2009	Pfister	
2010/0175280	A1		7/2010	Rinehart, Jr.	
2010/0186261	A1		7/2010	Baker	
2010/0218397	A1		9/2010	Nishiwaki et al.	
2010/0263228	A1		10/2010	Kang	
2011/0138652	A1		6/2011	Lucas	
2012/0317835	A1		12/2012	Raysse et al.	
2013/0192090	A1		8/2013	Smith	
2014/0068966	A1		3/2014	Chaffin	
2014/0101972	A1		4/2014	Ha	
2014/0230280	A1		8/2014	Heard et al.	
2014/0230283	A1	*	8/2014	Cordova	A43B 5/185 36/103
2014/0237852	A1		8/2014	Oberschneider et al.	
2014/0245640	A1		9/2014	Heard et al.	
2015/0047224	A1		2/2015	Zhao et al.	
2015/0107132	A1		4/2015	Takeshita	
2016/0262492	A1		9/2016	Fujita	
2017/0079376	A1		3/2017	Bunnell et al.	
2017/0105477	A1		4/2017	Wilkerson	
2017/0150779	A1		6/2017	Walker et al.	
2017/0245590	A1		8/2017	Kohatsu et al.	
2018/0027922	A1		2/2018	Orand	
2018/0035752	A1		2/2018	Walker et al.	
2018/0042338	A1		2/2018	Orand	
2018/0153254	A1		6/2018	Fusco et al.	
2018/0168281	A1		6/2018	Case et al.	
2018/0199666	A1		7/2018	Moriyasu et al.	
2018/0199675	A1		7/2018	Cook et al.	
2018/0235310	A1		8/2018	Wardlaw et al.	
2018/0271215	A1		9/2018	Foxen	
2018/0338568	A1		11/2018	Chambers et al.	
2018/0352902	A1		12/2018	Wardle	
2019/0082781	A1		3/2019	Iuchi et al.	
2019/0150558	A1		5/2019	Shorten	
2019/0150563	A1		5/2019	Shorten	
2019/0159547	A1		5/2019	Nakatsuka	
2019/0216169	A1		7/2019	Yahata	
2019/0246738	A1		8/2019	Connell et al.	
2019/0283355	A1		9/2019	Bartel et al.	
2019/0289961	A1		9/2019	Iuchi et al.	
2019/0320759	A1		10/2019	Conrad et al.	
2019/0365030	A1		12/2019	Chambers et al.	
2019/0365033	A1		12/2019	Chambers et al.	
2019/0365034	A1		12/2019	Connell et al.	
2019/0373982	A1		12/2019	Dupre et al.	
2020/0008519	A1		1/2020	Farris et al.	
2020/0046068	A1		2/2020	Choi et al.	
2020/0100564	A1		4/2020	Bunnell et al.	
2020/0121021	A1		4/2020	Bartel et al.	
2020/0281322	A1		9/2020	Caldwell et al.	
2020/0307134	A1	*	10/2020	Yoshida	A43B 13/04
2021/0015209	A1		1/2021	Buck	
2021/0030112	A1		2/2021	Amoako et al.	
2021/0052037	A1		2/2021	Greenspan	
2021/0085024	A1		3/2021	Chen	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2021/0368916	A1	12/2021	Wakasugi	
2022/0015505	A1 *	1/2022	Constantinou	A43B 5/02

FOREIGN PATENT DOCUMENTS

CA	70821	S		6/1992
CA	79616	S		12/1996
CA	80237	S		3/1997
CA	80238	S		3/1997
CA	97079	S		5/2002
CA	97944	S		6/2003
CA	142281	S		4/2012
CA	145865	S		2/2013
CA	147979	S		12/2013
CA	148731	S		1/2014
CA	150008	S		1/2014
CA	151213	S		3/2014
CA	151413	S		4/2014
CA	151425	S		4/2014
CA	151434	S		4/2014
CA	155362	S		10/2014
CA	155411	S		11/2014
CA	155435	S		3/2015
CA	155436	S		3/2015
CA	159823	S		7/2015
CA	165390	S		6/2016
CA	169350	S		7/2017
CA	169349	S		1/2018
CN	2904704	Y		5/2007
CN	302004098		*	3/2012
CN	302004098			7/2012
CN	204132549	U		2/2015
CN	204467084	U		7/2015
DE	4015138	A1		11/1991
DE	102012104264	A1		11/2013
DE	102018122753	A1		3/2019
DE	102019107402	A1		9/2019
EP	1483981	A1		12/2004
EP	1346655	B1		8/2006
EP	1525284	B1		6/2007
EP	2138063	A1		12/2009
EP	2689681	A1		1/2014
EP	2491807	B1		10/2014
EP	1847193	B1		1/2015
EP	1386553	B1		6/2015
EP	2269478	B1		9/2015
EP	1690460	B1		8/2016
EP	1894484	B1		3/2018
EP	2979567	B1		10/2018
EP	3399882	A1		11/2018
EP	2911542	B1		12/2018
EP	3422893	A1		1/2019
EP	3434132	A1		1/2019
EP	3174419	B1		7/2019
EP	3574791	A1		12/2019
EP	2938218	B1		3/2020
EP	3331393	B1		4/2020
EP	3316721	B1		5/2020
EP	3457882	B1		6/2020
EP	3355738	B1		8/2020
EP	3689171	A1		8/2020
EP	3771358	A1		2/2021
FR	2827126	A1		1/2003
FR	2932963	B1		8/2010
FR	2993758	B1		3/2015
GB	2376408	A		12/2002
JP	D1732464		*	12/2022
KR	100844183	B1		7/2008
TW	D145320			2/2012
TW	D154740			7/2013
VN	30025397			12/2017
VN	30025398			12/2017
VN	30025399			12/2017
WO	9842221	A1		10/1998
WO	2000074515	A1		12/2000
WO	2007113595	A2		10/2007
WO	2008125716	A1		10/2008
WO	2011020798	A1		2/2011
WO	2013023163	A1		2/2013
WO	2016094714	A1		6/2016
WO	2017023532	A1		2/2017
WO	2017120006	A1		7/2017
WO	2017151501	A1		9/2017
WO	2019157244	A1		8/2019
WO	2021016163	A1		1/2021

OTHER PUBLICATIONS

[Puma EvoSpeed Sprint 14], announced on YouTube on Jan. 5, 2023 [online], [site visited May 5, 2023], Available from the internet URL: Puma evoSpeed Sprint 14 SKU: 9787857 (Year: 2023).*

International Search Report of International Application No. PCT/IB2021/062487, dated Mar. 30, 2022, 7 pages.

Written Opinion of International Application No. PCT/IB2021/062487, dated Mar. 30, 2022, 7 pages.

[Adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https:// www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/BO119E37WS/ref=cm_cr_arp_d_product_topie=UTFS (Year: 2015).

* cited by examiner

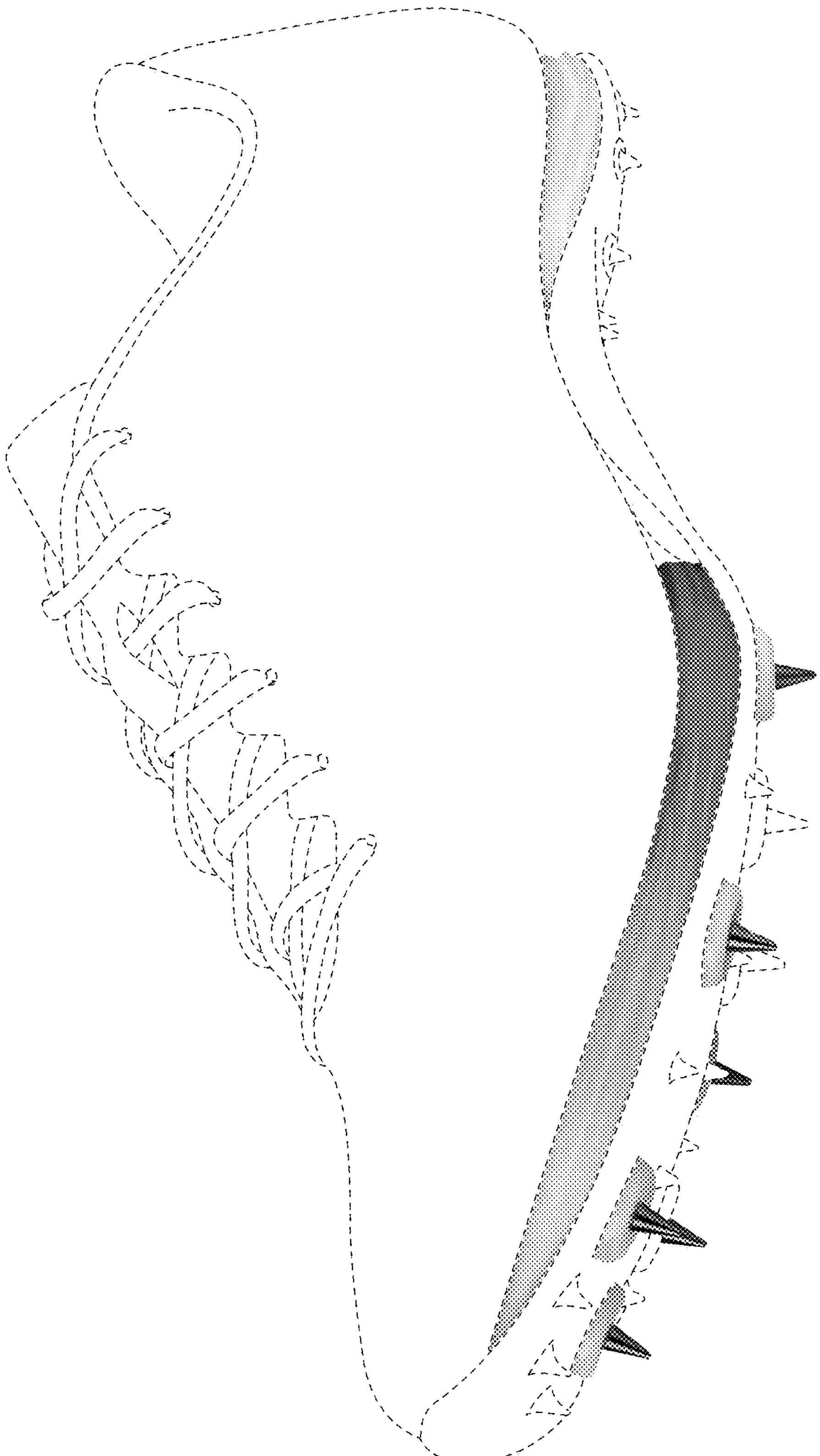


FIG. 1

FIG. 2

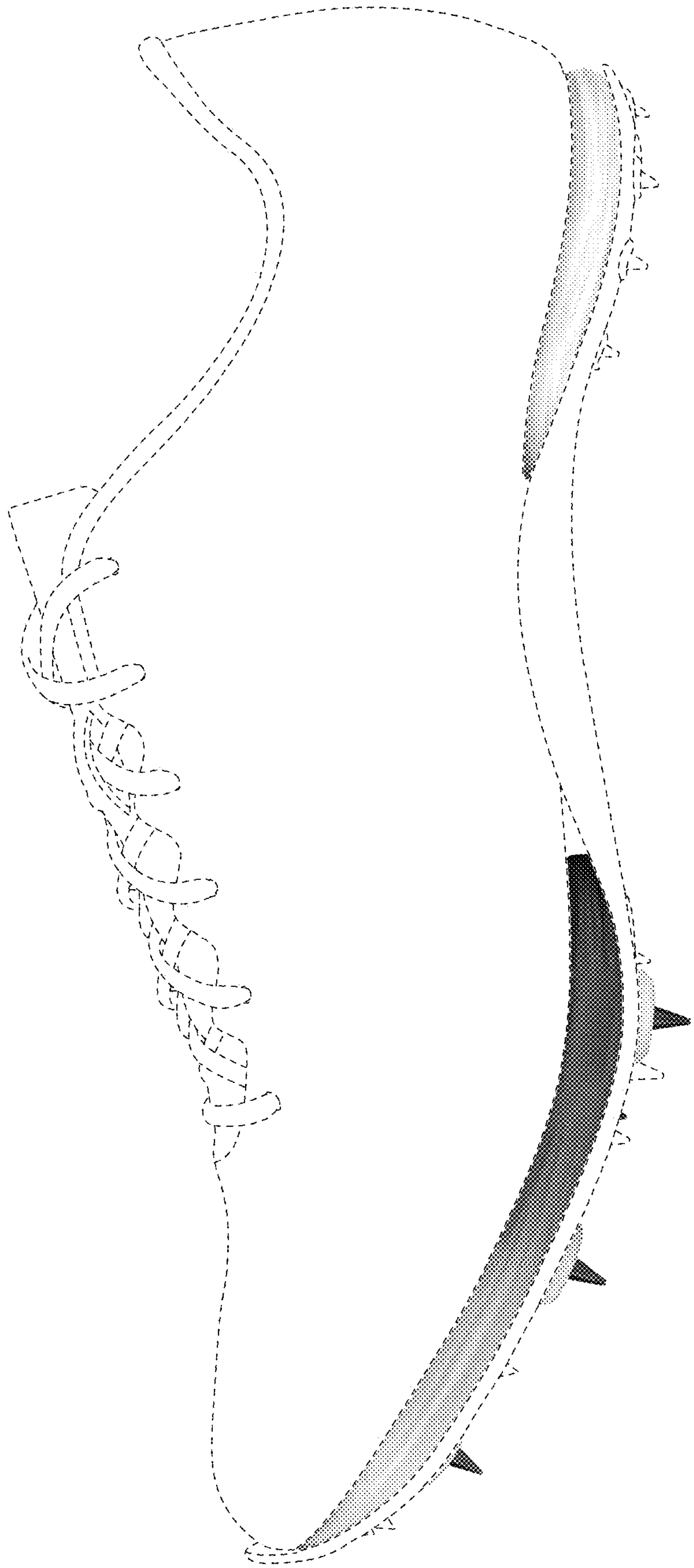


FIG. 3

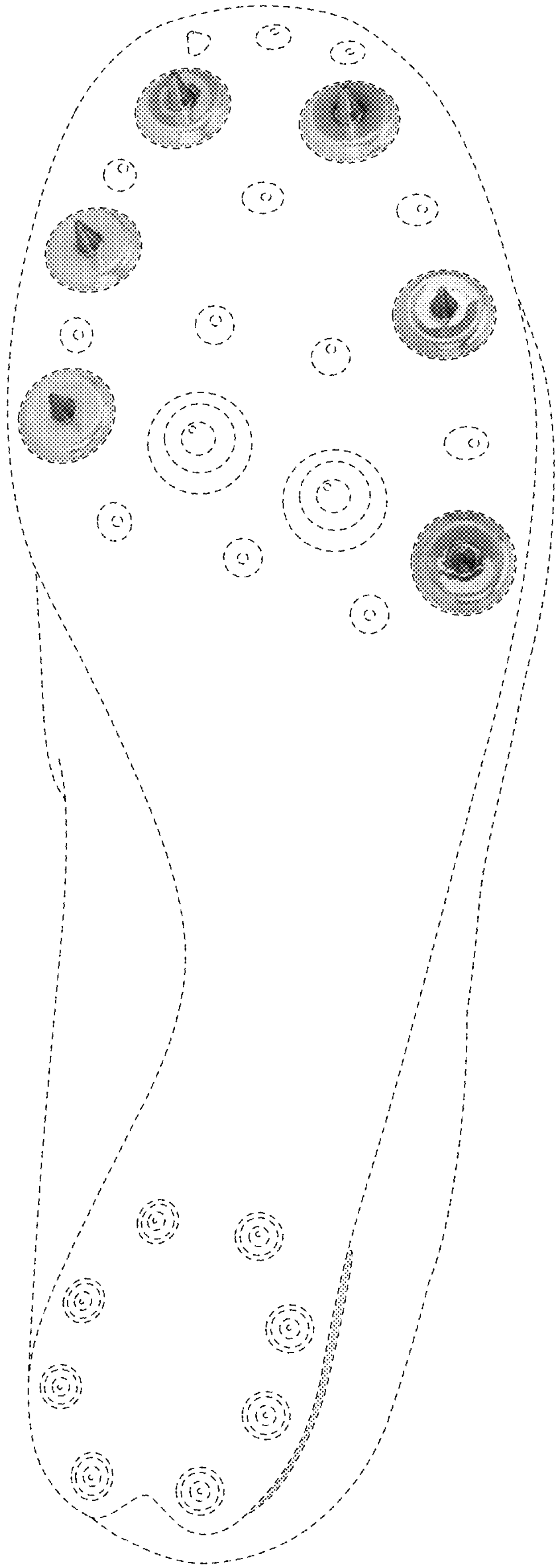


FIG. 4

EXHIBIT F

US0D1022422S

(12) **United States Design Patent** (10) **Patent No.: US D1,022,422 S**
Redon (45) **Date of Patent: ** Apr. 16, 2024**

(54) **SHOE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

(72) Inventor: **Arnaud Redon**, Nuremberg (DE)

(73) Assignee: **PUMA SE**, Herzogenaurach (DE)

(**) Term: **15 Years**

(21) Appl. No.: **29/891,198**

(22) Filed: **May 2, 2023**

Related U.S. Application Data

(63) Continuation of application No. 29/797,495, filed on Jun. 30, 2021.

(51) **LOC (14) Cl.** **02-04**

(52) **U.S. Cl.**
USPC **D2/947**

(58) **Field of Classification Search**
USPC D2/902, 906, 908, 916, 918, 925, D2/946–962, 972, 977
CPC A43B 13/00; A43B 13/02; A43B 13/023; A43B 13/026; A43B 13/04; A43B 13/08; A43B 13/10; A43B 13/12; A43B 13/14; A43B 13/20; A43B 13/24; A43B 13/28; A43B 13/30; A43B 13/32; A43B 13/34; A43B 13/36; A43B 13/181; A43B 13/187; A43B 13/189; A43B 13/223
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

324,065	A	8/1885	Andrews
413,693	A	10/1889	Walker
634,588	A	10/1899	Roche
1,088,328	A	2/1914	Cucinotta et al.
1,827,514	A	10/1931	Golden
D158,403	S	5/1950	Pierce
2,578,591	A	12/1951	Phillips
D208,393	S	8/1967	Onitsuka
3,402,484	A	9/1968	Brutting
D232,200	S	7/1974	Inohara
4,020,569	A	5/1977	Fukuoka

(Continued)

FOREIGN PATENT DOCUMENTS

CA	38477	S	12/1974
CA	70286	S	3/1992

(Continued)

OTHER PUBLICATIONS

[Adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https://www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/B0119E37WS/ref=cm_cr_arp_d_product_top?ie=UTF8 (Year: 2015).*

(Continued)

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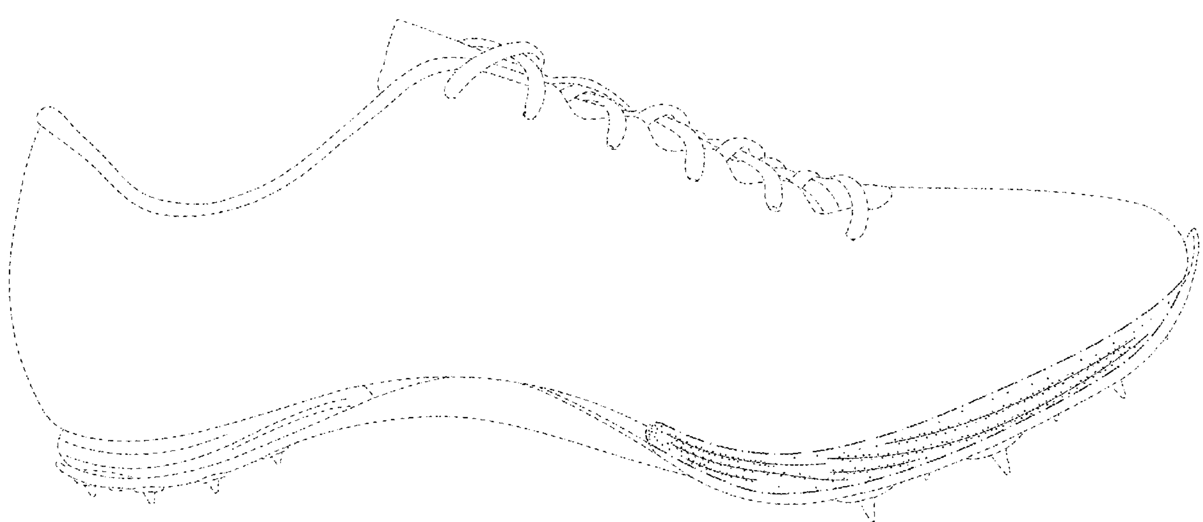
(57) **CLAIM**

The ornamental design for a shoe, as shown and described.

DESCRIPTION

FIG. **1** is a top, right, and front perspective view of an ornamental design for a shoe;
FIG. **2** is a left side elevational view of the shoe of FIG. **1**; and,
FIG. **3** is a right side elevational view of the shoe of FIG. **1**.
The dash-dot-dash lines are included for the purpose of illustrating boundary lines and form no part of the claimed design. The dash-dash-dash lines are included for the purpose of illustrating portions of the shoe that form no part of the claimed design.

1 Claim, 3 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,241,523 A 12/1980 Daswick
4,348,821 A 9/1982 Daswick
4,392,312 A 7/1983 Crowley
4,463,505 A 8/1984 Duclos
4,492,046 A 1/1985 Kosova
4,510,700 A 4/1985 Brown
4,542,598 A 9/1985 Misevich et al.
4,910,884 A 3/1990 Lindh et al.
5,024,007 A 6/1991 DuFour
5,052,130 A 10/1991 Barry et al.
D327,165 S 6/1992 Hatfield
5,138,776 A 8/1992 Levin
5,191,727 A 3/1993 Barry et al.
5,203,095 A 4/1993 Allen
D341,480 S 11/1993 Saito
5,339,544 A * 8/1994 Caberlotto A43B 23/0255
36/43
D350,638 S 9/1994 Yoshikawa
5,353,523 A 10/1994 Kilgore et al.
5,435,079 A 7/1995 Gallegos
5,461,800 A 10/1995 Uthi et al.
5,528,842 A 6/1996 Ricci et al.
D377,411 S 1/1997 Murray
5,592,757 A 1/1997 Jackinsky
D378,472 S 3/1997 Bramani
5,706,589 A 1/1998 Marc
D396,139 S 7/1998 Dietrich
5,806,209 A 9/1998 Crowley et al.
D401,741 S 12/1998 Clarke
5,875,567 A 3/1999 Bayley
D415,607 S 10/1999 Merceron
6,029,374 A 2/2000 Herr et al.
D423,201 S 4/2000 Wilson
D454,426 S 3/2002 Wilson
6,502,330 B1 1/2003 David et al.
6,505,421 B1 1/2003 Vaz
D473,042 S 4/2003 Wilson
D473,047 S 4/2003 Wilson
D476,800 S 7/2003 Fuerst
6,775,930 B2 8/2004 Fuerst
D498,901 S 11/2004 Hawker
6,826,852 B2 12/2004 Fusco
6,857,205 B1 2/2005 Fusco et al.
D507,398 S 7/2005 Recchi
6,944,972 B2 9/2005 Schmid
D511,617 S 11/2005 Matis
7,013,582 B2 3/2006 Lucas et al.
7,016,867 B2 3/2006 Lyden
7,096,605 B1 8/2006 Kozo et al.
7,100,308 B2 9/2006 Aveni
7,100,309 B2 9/2006 Smith et al.
7,107,235 B2 9/2006 Lyden
7,152,343 B2 12/2006 Whatley
7,219,447 B2 5/2007 LeVert
7,350,320 B2 4/2008 Chandler et al.
7,401,419 B2 7/2008 Lucas et al.
7,401,422 B1 7/2008 Scholz et al.
7,434,337 B2 10/2008 Gibert et al.
7,484,317 B2 2/2009 Kita et al.
7,513,065 B2 4/2009 Kita et al.
7,624,515 B2 12/2009 Kita et al.
7,644,518 B2 1/2010 Chandler et al.
D615,738 S 5/2010 Teteriatnikov
7,707,743 B2 5/2010 Schindler et al.
7,786,193 B2 8/2010 Wilding et al.
7,832,117 B2 11/2010 Auger et al.
7,886,461 B2 2/2011 Sato
7,900,376 B2 3/2011 Rabushka
D637,803 S 5/2011 Alvear
7,950,091 B2 5/2011 Auger et al.
7,987,618 B2 8/2011 Nishiwaki et al.
8,028,442 B2 10/2011 Hodgson
8,074,377 B2 12/2011 Nishiwaki et al.
8,079,160 B2 12/2011 Baucom et al.
8,112,909 B2 2/2012 Kubo et al.
8,122,615 B2 2/2012 Lucas et al.
D666,795 S 9/2012 Shaffer
D672,123 S 12/2012 Williams, Jr.
8,341,856 B2 1/2013 Smith et al.
8,393,028 B2 3/2013 Namkook et al.
D680,308 S 4/2013 Hardman
8,418,379 B2 4/2013 Nishiwaki et al.
D685,166 S 7/2013 Hatfield
D688,037 S * 8/2013 Dekovic D2/962
D690,088 S 9/2013 Hardman
D692,217 S 10/2013 Fogg
8,567,094 B2 10/2013 Lubart
D694,498 S 12/2013 Carboy
D694,499 S 12/2013 Williams, Jr.
8,613,149 B2 12/2013 Schwirian
8,615,901 B2 12/2013 Caine et al.
D707,428 S * 6/2014 Seamarks D2/947
8,776,397 B2 7/2014 Borel et al.
D710,579 S 8/2014 Williams, Jr.
D713,625 S 9/2014 Raasch
D713,626 S 9/2014 Raasch
D714,035 S 9/2014 O'Connor
8,850,718 B2 10/2014 Lubart
8,919,015 B2 12/2014 Holt et al.
8,945,449 B2 2/2015 Atwal et al.
8,978,274 B2 3/2015 Auger et al.
8,984,775 B2 3/2015 Dombrow et al.
9,009,988 B2 4/2015 Jacobs et al.
D731,767 S 6/2015 Lan
9,066,559 B2 6/2015 Butler
9,144,265 B2 9/2015 Lubart
9,167,864 B1 10/2015 Piontkowski et al.
D743,153 S 11/2015 Taylor
9,179,733 B2 11/2015 Peyton et al.
9,204,686 B2 12/2015 Baum et al.
9,210,967 B2 12/2015 Gerber
D746,560 S 1/2016 Verfl
D747,083 S 1/2016 Verfl
9,241,533 B2 1/2016 Heard et al.
9,259,050 B2 2/2016 Smith et al.
D756,620 S 5/2016 Boys
9,326,562 B2 5/2016 Weidl et al.
9,339,079 B2 5/2016 Lucas et al.
9,375,048 B2 6/2016 James et al.
D768,969 S 10/2016 Boys
D770,739 S 11/2016 Nethongkome
D770,740 S 11/2016 Teteriatnikov
9,491,983 B2 11/2016 Rushbrook
9,516,916 B2 12/2016 Derrier
9,549,589 B2 1/2017 Auger et al.
D779,175 S 2/2017 Greenhalgh
9,572,394 B2 2/2017 Heard et al.
9,572,398 B2 2/2017 Hurd et al.
D782,790 S 4/2017 Lee
9,615,625 B1 4/2017 Huard et al.
9,661,896 B2 5/2017 Elliott et al.
D789,054 S 6/2017 Shyllon
D790,169 S 6/2017 da Costa Pereira Machado
D790,183 S 6/2017 VanHook
9,668,540 B2 6/2017 Scofield et al.
D791,453 S 7/2017 McMillan
D793,046 S 8/2017 Lee
D795,541 S 8/2017 Henrichot
D796,168 S 9/2017 Shyllon
D796,799 S 9/2017 Shyllon
9,750,306 B2 9/2017 Baum et al.
D798,551 S 10/2017 Shyllon
D798,554 S 10/2017 Swierszczk
D798,555 S 10/2017 Enayah
D798,558 S 10/2017 Pauk
9,775,404 B2 10/2017 Lyden
9,820,528 B2 11/2017 Reinhardt et al.
9,820,529 B2 11/2017 Droege et al.
D810,411 S 2/2018 Klein
9,883,714 B2 2/2018 Cavaliere et al.
9,894,958 B2 2/2018 Cheney et al.
D812,871 S 3/2018 Reyes
D815,816 S 4/2018 Cin
D815,817 S 4/2018 Cin

(56) **References Cited**

U.S. PATENT DOCUMENTS

D815,818	S		4/2018	Cin	
D815,820	S		4/2018	Cin	
D815,821	S		4/2018	Cin	
D815,822	S		4/2018	Cin	
D815,823	S		4/2018	Cin	
9,930,934	B2		4/2018	Cook et al.	
D816,310	S		5/2018	Cooper	
D816,311	S		5/2018	Cin	
D816,959	S		5/2018	Cin	
D816,960	S		5/2018	Cin	
D817,614	S		5/2018	Cin	
D817,615	S		5/2018	Cin	
D817,616	S		5/2018	Cin	
9,961,959	B2		5/2018	Gerber	
9,968,157	B2		5/2018	Wardlaw et al.	
9,968,160	B2		5/2018	Peyton	
10,010,135	B2		7/2018	Lovell et al.	
10,010,137	B2		7/2018	Foxen	
10,016,919	B2		7/2018	Cook et al.	
10,111,491	B2		10/2018	Tanabe et al.	
10,159,303	B2		12/2018	Wang et al.	
10,165,821	B2		1/2019	Truelsen	
10,165,824	B2		1/2019	Auger et al.	
10,226,097	B2		3/2019	Farris et al.	
10,231,517	B2		3/2019	Baucom et al.	
10,271,614	B2		4/2019	Huard et al.	
D847,478	S		5/2019	Fracassi	
10,299,535	B2		5/2019	Hurd et al.	
10,314,365	B2		6/2019	James et al.	
10,314,367	B2		6/2019	Kilgore et al.	
D853,097	S		7/2019	Cass	
D853,701	S		7/2019	Hong	
10,349,700	B2		7/2019	Amis et al.	
D855,301	S		8/2019	Williams, Jr.	
D862,046	S		10/2019	Page	
10,433,616	B2		10/2019	Takeshita et al.	
10,441,027	B2		10/2019	Bartel et al.	
10,448,701	B2		10/2019	Farris et al.	
10,448,704	B2		10/2019	Dupre et al.	
D870,429	S		12/2019	Becker	
10,512,301	B2		12/2019	Peyton	
10,517,350	B2		12/2019	Orand et al.	
10,517,351	B2		12/2019	Arciuolo	
10,524,536	B2		1/2020	Bunnell et al.	
10,548,368	B2		2/2020	Bartel et al.	
10,595,587	B2		3/2020	Cook et al.	
D882,918	S		5/2020	Kosenick	
10,653,205	B2		5/2020	Orand	
D885,718	S		6/2020	Roulo	
D889,798	S		7/2020	Vella	
10,743,606	B2		8/2020	Bartel et al.	
10,743,607	B2		8/2020	Amis et al.	
10,750,817	B2		8/2020	Barnes et al.	
10,758,001	B2		9/2020	Case et al.	
D912,947	S		3/2021	Boys	
D912,948	S		3/2021	Boys	
D913,655	S		3/2021	Boys	
D913,663	S	*	3/2021	Essilfie-Taylor	D2/947
D913,668	S		3/2021	Boys	
D917,848	S		5/2021	Wehrmeyer	
D922,741	S		6/2021	Boys	
D922,742	S		6/2021	Boys	
D929,097	S		8/2021	Winskowicz	
D938,145	S		12/2021	Rezab	
D940,443	S		1/2022	Papp	
D948,853	S		4/2022	Jenkins	
D950,211	S		5/2022	Tejada Bernard	
D954,417	S	*	6/2022	Bidal	D2/954
D964,717	S	*	9/2022	Mahoney	D2/947
D973,337	S	*	12/2022	Lesecq	D2/962
D976,564	S		1/2023	Klug	
D978,508	S		2/2023	Schneider	
2002/0174567	A1		11/2002	Krafsur et al.	
2003/0208929	A1		11/2003	Lucas et al.	
2003/0233770	A1		12/2003	Foscaro	
2004/0107601	A1		6/2004	Schmid	
2004/0200097	A1	*	10/2004	Boyd	A43B 5/02 36/74
2005/0102858	A1		5/2005	Yen	
2005/0126039	A1		6/2005	LeVert	
2005/0166422	A1		8/2005	Schaeffer et al.	
2005/0262739	A1		12/2005	McDonald	
2006/0196084	A1	*	9/2006	Kos	A43B 1/0081 36/133
2007/0043630	A1		2/2007	Lyden	
2007/0101617	A1		5/2007	Brewer et al.	
2007/0240331	A1		10/2007	Borel	
2007/0266593	A1		11/2007	Schindler et al.	
2007/0271818	A1		11/2007	Rabushka	
2008/0072462	A1		3/2008	Fusco	
2008/0189982	A1		8/2008	Krafsur	
2009/0100718	A1	*	4/2009	Gerber	A43C 15/04 36/67 A
2009/0183393	A1		7/2009	Lee	
2009/0307925	A1		12/2009	Pfister	
2010/0175280	A1		7/2010	Rinehart, Jr.	
2010/0186261	A1		7/2010	Baker	
2010/0218397	A1		9/2010	Nishiwaki et al.	
2010/0263228	A1		10/2010	Kang	
2011/0138652	A1		6/2011	Lucas	
2012/0317835	A1		12/2012	Raysse et al.	
2013/0192090	A1		8/2013	Smith	
2014/0068966	A1		3/2014	Chaffin	
2014/0101972	A1		4/2014	Ha	
2014/0230280	A1		8/2014	Heard et al.	
2014/0230283	A1	*	8/2014	Cordova	A43B 5/185 36/103
2014/0237852	A1		8/2014	Oberschneider et al.	
2014/0245640	A1		9/2014	Heard et al.	
2015/0047224	A1		2/2015	Zhao et al.	
2015/0107132	A1		4/2015	Takeshita	
2016/0262492	A1		9/2016	Fujita	
2017/0079376	A1		3/2017	Bunnell et al.	
2017/0105477	A1		4/2017	Wilkerson	
2017/0150779	A1		6/2017	Walker et al.	
2017/0245590	A1		8/2017	Kohatsu et al.	
2018/0027922	A1		2/2018	Orand	
2018/0035752	A1		2/2018	Walker et al.	
2018/0042338	A1		2/2018	Orand	
2018/0153254	A1		6/2018	Fusco et al.	
2018/0168281	A1		6/2018	Case et al.	
2018/0199666	A1		7/2018	Moriyasu et al.	
2018/0199675	A1		7/2018	Cook et al.	
2018/0235310	A1		8/2018	Wardlaw et al.	
2018/0271215	A1		9/2018	Foxen	
2018/0338568	A1		11/2018	Chambers et al.	
2018/0352902	A1		12/2018	Wardle	
2019/0082781	A1		3/2019	Iuchi et al.	
2019/0150558	A1		5/2019	Shorten	
2019/0150563	A1		5/2019	Shorten	
2019/0159547	A1		5/2019	Nakatsuka	
2019/0216169	A1		7/2019	Yahata	
2019/0246738	A1		8/2019	Connell et al.	
2019/0283355	A1		9/2019	Bartel et al.	
2019/0289961	A1		9/2019	Iuchi et al.	
2019/0320759	A1		10/2019	Conrad et al.	
2019/0365030	A1		12/2019	Chambers et al.	
2019/0365033	A1		12/2019	Chambers et al.	
2019/0365034	A1		12/2019	Connell et al.	
2019/0373982	A1		12/2019	Dupre et al.	
2020/0008519	A1		1/2020	Farris et al.	
2020/0046068	A1		2/2020	Choi et al.	
2020/0100564	A1		4/2020	Bunnell et al.	
2020/0121021	A1		4/2020	Bartel et al.	
2020/0281322	A1		9/2020	Caldwell et al.	
2020/0307134	A1	*	10/2020	Yoshida	A43B 13/04
2021/0015209	A1		1/2021	Buck	
2021/0030112	A1		2/2021	Amoako et al.	
2021/0052037	A1		2/2021	Greenspan	
2021/0085024	A1		3/2021	Chen	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2021/0368916	A1	12/2021	Wakasugi	
2022/0015505	A1 *	1/2022	Constantinou	A43B 5/02

FOREIGN PATENT DOCUMENTS

CA	70821	S		6/1992
CA	79616	S		12/1996
CA	80237	S		3/1997
CA	80238	S		3/1997
CA	97079	S		5/2002
CA	97944	S		6/2003
CA	142281	S		4/2012
CA	145865	S		2/2013
CA	147979	S		12/2013
CA	148731	S		1/2014
CA	150008	S		1/2014
CA	151213	S		3/2014
CA	151413	S		4/2014
CA	151425	S		4/2014
CA	151434	S		4/2014
CA	155362	S		10/2014
CA	155411	S		11/2014
CA	155435	S		3/2015
CA	155436	S		3/2015
CA	159823	S		7/2015
CA	165390	S		6/2016
CA	169350	S		7/2017
CA	169349	S		1/2018
CN	2904704	Y		5/2007
CN	302004098		*	3/2012
CN	302004098			7/2012
CN	204132549	U		2/2015
CN	204467084	U		7/2015
DE	4015138	A1		11/1991
DE	102012104264	A1		11/2013
DE	102018122753	A1		3/2019
DE	102019107402	A1		9/2019
EP	1483981	A1		12/2004
EP	1346655	B1		8/2006
EP	1525284	B1		6/2007
EP	2138063	A1		12/2009
EP	2689681	A1		1/2014
EP	2491807	B1		10/2014
EP	1847193	B1		1/2015
EP	1386553	B1		6/2015
EP	2269478	B1		9/2015
EP	1690460	B1		8/2016
EP	1894484	B1		3/2018
EP	2979567	B1		10/2018
EP	3399882	A1		11/2018
EP	2911542	B1		12/2018
EP	3422893	A1		1/2019
EP	3434132	A1		1/2019
EP	3174419	B1		7/2019
EP	3574791	A1		12/2019
EP	2938218	B1		3/2020
EP	3331393	B1		4/2020
EP	3316721	B1		5/2020
EP	3457882	B1		6/2020
EP	3355738	B1		8/2020
EP	3689171	A1		8/2020
EP	3771358	A1		2/2021
FR	2827126	A1		1/2003
FR	2932963	B1		8/2010
FR	2993758	B1		3/2015
GB	2376408	A		12/2002
JP	D1732464		*	12/2022
KR	100844183	B1		7/2008
TW	D145320			2/2012
TW	D154740			7/2013
VN	30025397			12/2017
VN	30025398			12/2017
VN	30025399			12/2017
WO	9842221	A1		10/1998
WO	2000074515	A1		12/2000
WO	2007113595	A2		10/2007
WO	2008125716	A1		10/2008
WO	2011020798	A1		2/2011
WO	2013023163	A1		2/2013
WO	2016094714	A1		6/2016
WO	2017023532	A1		2/2017
WO	2017120006	A1		7/2017
WO	2017151501	A1		9/2017
WO	2019157244	A1		8/2019
WO	2021016163	A1		1/2021

OTHER PUBLICATIONS

[Puma EvoSpeed Sprint 14], announced on YouTube on Jan. 5, 2023 [online], [site visited May 5, 2023], Available from the internet URL: Puma evoSpeed Sprint 14 SKU: 9787857 (Year: 2023).*

International Search Report of International Application No. PCT/IB2021/062487, dated Mar. 30, 2022, 7 pages.

Written Opinion of International Application No. PCT/IB2021/062487, dated Mar. 30, 2022, 7 pages.

[Adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https:// www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/BO119E37WS/ref=cm_cr_arp_d_product_topie=UTFS (Year: 2015).

* cited by examiner

FIG. 1

FIG. 2

FIG. 3

EXHIBIT G

US0D1023531S

(12) **United States Design Patent** (10) **Patent No.: US D1,023,531 S**
Redon (45) **Date of Patent: ** Apr. 23, 2024**

(54) **SHOE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

(72) Inventor: **Arnaud Redon**, Nuremberg (DE)

(73) Assignee: **PUMA SE**, Herzogenaurach (DE)

(**) Term: **15 Years**

(21) Appl. No.: **29/891,911**

(22) Filed: **May 11, 2023**

Related U.S. Application Data

(63) Continuation of application No. 29/891,198, filed on May 2, 2023, and a continuation of application No. 29/891,188, filed on May 2, 2023, which is a continuation of application No. 29/797,495, filed on Jun. 30, 2021, now Pat. No. Des. 1,010,297, said application No. 29/891,198 is a continuation of application No. 29/797,495, filed on Jun. 30, 2021, now Pat. No. Des. 1,010,297.

(51) **LOC (14) Cl.** **02-04**

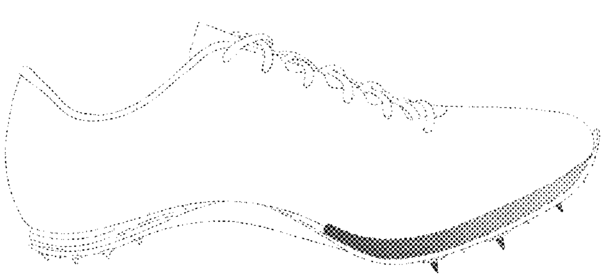
(52) **U.S. Cl.**
USPC **D2/947**; D2/962; D2/954; D2/959; D2/906

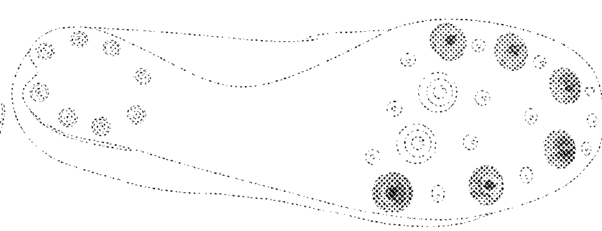
(58) **Field of Classification Search**
USPC D2/902, 906, 908, 916, 918, 925, D2/946–962, 972, 977
CPC A43B 13/00; A43B 13/02; A43B 13/023; A43B 13/026; A43B 13/04; A43B 13/08; A43B 13/10; A43B 13/12; A43B 13/14; A43B 13/20; A43B 13/24; A43B 13/28; A43B 13/30; A43B 13/32; A43B 13/34; A43B 13/36; A43B 13/181; A43B 13/187; A43B 13/189; A43B 13/223
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

324,065 A		8/1885	Andrews	
413,693 A		10/1889	Walker	
634,588 A		10/1899	Roche	
1,088,328 A		2/1914	Cucinotta et al.	
1,827,514 A		10/1931	Golden	
D158,403 S		5/1950	Pierce	
2,578,591 A		12/1951	Phillips	
D208,393 S		8/1967	Onitsuka	
3,402,484 A		9/1968	Brutting	
D232,200 S		7/1974	Masanobu	
4,020,569 A		5/1977	Fukuoka	
4,241,523 A		12/1980	Daswick	
4,348,821 A		9/1982	Daswick	
4,392,312 A		7/1983	Crowley	
4,463,505 A		8/1984	Duclos	
4,492,046 A		1/1985	Kosova	
4,510,700 A		4/1985	Brown	
4,542,598 A		9/1985	Misevich et al.	
4,910,884 A		3/1990	Lindh et al.	
5,024,007 A		6/1991	DuFour	
5,052,130 A		10/1991	Barry et al.	
D327,165 S		6/1992	Hatfield	
5,138,776 A		8/1992	Levin	
5,191,727 A		3/1993	Barry et al.	
5,203,095 A		4/1993	Allen	
D341,480 S		11/1993	Saito	
5,339,544 A	*	8/1994	Caberlotto	.... A43B 23/0255 36/43
D350,638 S		9/1994	Yoshikawa	
5,353,523 A		10/1994	Kilgore et al.	
5,435,079 A		7/1995	Gallegos	
5,461,800 A		10/1995	Luthi et al.	
5,528,842 A		6/1996	Ricci et al.	
D377,411 S		1/1997	Murray	
5,592,757 A		1/1997	Jackinsky	
D378,472 S		3/1997	Bramani	
5,706,589 A		1/1998	Marc	
D396,139 S		7/1998	Dietrich	
5,806,209 A		9/1998	Crowley et al.	
D401,741 S		12/1998	Clarke	
5,875,567 A		3/1999	Bayley	
D415,607 S		10/1999	Merceron	
6,029,374 A		2/2000	Herr et al.	
D423,201 S		4/2000	Wilson	
D454,426 S		3/2002	Wilson	
6,502,330 B1		1/2003	David et al.	
6,505,421 B1		1/2003	Vaz	
D473,042 S		4/2003	Wilson	
D473,047 S		4/2003	Wilson	
D476,800 S		7/2003	Fuerst	
6,775,930 B2		8/2004	Fuerst	
D498,901 S		11/2004	Hawker	
6,826,852 B2		12/2004	Fusco	
6,857,205 B1		2/2005	Fusco et al.	
D507,398 S		7/2005	Recchi	





6,944,972 B2 9/2005 Schmid
D511,617 S 11/2005 Matis
7,013,582 B2 3/2006 Lucas et al.
7,016,867 B2 3/2006 Lyden
7,096,605 B1 8/2006 Kozo et al.
7,100,308 B2 9/2006 Aveni
7,100,309 B2 9/2006 Smith et al.
7,107,235 B2 9/2006 Lyden
7,152,343 B2 12/2006 Whatley
7,219,447 B2 5/2007 LeVert
7,350,320 B2 4/2008 Chandler et al.
7,401,419 B2 7/2008 Lucas et al.
7,401,422 B1 7/2008 Scholz et al.
7,434,337 B2 10/2008 Gibert et al.
7,484,317 B2 2/2009 Kita et al.
7,513,065 B2 4/2009 Kita et al.
7,624,515 B2 12/2009 Kita et al.
7,644,518 B2 1/2010 Chandler et al.
D615,738 S 5/2010 Teteriatnikov
7,707,743 B2 5/2010 Schindler et al.
7,786,193 B2 8/2010 Wilding et al.
7,832,117 B2 11/2010 Auger et al.
7,886,461 B2 2/2011 Sato
7,900,376 B2 3/2011 Rabushka
D637,803 S 5/2011 Alvear
7,950,091 B2 5/2011 Auger et al.
7,987,618 B2 8/2011 Nishiwaki et al.
8,028,442 B2 10/2011 Hodgson
8,074,377 B2 12/2011 Nishiwaki et al.
8,079,160 B2 12/2011 Baucom et al.
8,112,909 B2 2/2012 Kubo et al.
8,122,615 B2 2/2012 Lucas et al.
D666,795 S 9/2012 Shaffer
D672,123 S 12/2012 Williams, Jr.
8,341,856 B2 1/2013 Smith et al.
8,393,028 B2 3/2013 Namkook et al.
D680,308 S 4/2013 Hardman
8,418,379 B2 4/2013 Nishiwaki et al.
D685,166 S 7/2013 Hatfield
D688,037 S * 8/2013 Dekovic D2/962
D690,088 S 9/2013 Hardman
D692,217 S 10/2013 Fogg
8,567,094 B2 10/2013 Lubart
D694,498 S 12/2013 Carboy
D694,499 S 12/2013 Williams, Jr.
8,613,149 B2 12/2013 Schwirian
8,615,901 B2 12/2013 Caine et al.
D707,428 S * 6/2014 Seamarks D2/947
8,776,397 B2 7/2014 Borel et al.
D710,579 S 8/2014 Williams, Jr.
D713,625 S 9/2014 Raasch
D713,626 S 9/2014 Raasch
D714,035 S 9/2014 O'Connor
8,850,718 B2 10/2014 Lubart
8,919,015 B2 12/2014 Holt et al.
8,945,449 B2 2/2015 Atwal et al.
8,978,274 B2 3/2015 Auger et al.
8,984,775 B2 3/2015 Dombrow et al.
9,009,988 B2 4/2015 Jacobs et al.
D731,767 S 6/2015 Lan
9,066,559 B2 6/2015 Butler
9,144,265 B2 9/2015 Lubart
9,167,864 B1 10/2015 Piontkowski et al.
D743,153 S 11/2015 Taylor
9,179,733 B2 11/2015 Peyton et al.
9,204,686 B2 12/2015 Baum et al.
9,210,967 B2 12/2015 Gerber
D746,560 S 1/2016 Verfl
D747,083 S 1/2016 Verfl
9,241,533 B2 1/2016 Heard et al.
9,259,050 B2 2/2016 Smith et al.
D756,620 S 5/2016 Boys
9,326,562 B2 5/2016 Weidi et al.
9,339,079 B2 5/2016 Lucas et al.
9,375,048 B2 6/2016 James et al.
D768,969 S 10/2016 Boys
D770,739 S 11/2016 Nethongkome
D770,740 S 11/2016 Teteriatnikov
9,491,983 B2 11/2016 Rushbrook
9,516,916 B2 12/2016 Derrier
9,549,589 B2 1/2017 Auger et al.
D779,175 S 2/2017 Greenhalgh
9,572,394 B2 2/2017 Heard et al.
9,572,398 B2 2/2017 Hurd et al.
D782,790 S 4/2017 Lee
9,615,625 B1 4/2017 Huard et al.
9,661,896 B2 5/2017 Elliott et al.
D789,054 S 6/2017 Shyllon
D790,169 S 6/2017 da Costa Pereira Machado
D790,183 S 6/2017 VanHook
9,668,540 B2 6/2017 Scofield et al.
D791,453 S 7/2017 McMillan
D793,046 S 8/2017 Lee
D795,541 S 8/2017 Henrichot
D796,168 S 9/2017 Shyllon
D796,799 S 9/2017 Shyllon
9,750,306 B2 9/2017 Baum et al.
D798,551 S 10/2017 Shyllon
D798,554 S 10/2017 Swierszczk
D798,555 S 10/2017 Enayah
D798,558 S 10/2017 Pauk
9,775,404 B2 10/2017 Lyden
9,820,528 B2 11/2017 Reinhardt et al.
9,820,529 B2 11/2017 Droege et al.
D810,411 S 2/2018 Klein
9,883,714 B2 2/2018 Cavaliere et al.
9,894,958 B2 2/2018 Cheney et al.
D812,871 S 3/2018 Reyes
D815,816 S 4/2018 Cin
D815,817 S 4/2018 Cin
D815,818 S 4/2018 Cin
D815,820 S 4/2018 Cin
D815,821 S 4/2018 Cin
D815,822 S 4/2018 Cin
D815,823 S 4/2018 Cin
9,930,934 B2 4/2018 Cook et al.
D816,310 S 5/2018 Cooper
D816,311 S 5/2018 Cin
D816,959 S 5/2018 Cin
D816,960 S 5/2018 Cin
D817,614 S 5/2018 Cin
D817,615 S 5/2018 Cin
D817,616 S 5/2018 Cin
9,961,959 B2 5/2018 Gerber
9,968,157 B2 5/2018 Wardlaw et al.
9,968,160 B2 5/2018 Peyton
10,010,135 B2 7/2018 Lovell et al.
10,010,137 B2 7/2018 Foxen
10,016,919 B2 7/2018 Cook et al.
10,111,491 B2 10/2018 Tanabe et al.
10,159,303 B2 12/2018 Wang et al.
10,165,821 B2 1/2019 Truelsen
10,165,824 B2 1/2019 Auger et al.
10,226,097 B2 3/2019 Farris et al.
10,231,517 B2 3/2019 Baucom et al.
10,271,614 B2 4/2019 Huard et al.
D847,478 S 5/2019 Fracassi
10,299,535 B2 5/2019 Hurd et al.
10,314,365 B2 6/2019 James et al.
10,314,367 B2 6/2019 Kilgore et al.
D853,097 S 7/2019 Cass
D853,701 S 7/2019 Hong
10,349,700 B2 7/2019 Amis et al.
D855,301 S 8/2019 Williams, Jr.
D862,046 S 10/2019 Page
10,433,616 B2 10/2019 Takeshita et al.
10,441,027 B2 10/2019 Bartel et al.
10,448,701 B2 10/2019 Farris et al.
10,448,704 B2 10/2019 Dupre et al.
D870,429 S 12/2019 Becker
10,512,301 B2 12/2019 Peyton
10,517,350 B2 12/2019 Orand et al.
10,517,351 B2 12/2019 Arciuolo
10,524,536 B2 1/2020 Bunnell et al.
10,548,368 B2 2/2020 Bartel et al.
10,595,587 B2 3/2020 Cook et al.
D882,918 S 5/2020 Kosenick
10,653,205 B2 5/2020 Orand

D885,718 S 6/2020 Roulo
D889,798 S 7/2020 Vella
10,743,606 B2 8/2020 Bartel et al.
10,743,607 B2 8/2020 Amis et al.
10,750,817 B2 8/2020 Bames et al.
10,758,001 B2 9/2020 Case et al.
D912,947 S 3/2021 Boys
D912,948 S 3/2021 Boys
D913,655 S 3/2021 Boys
D913,663 S * 3/2021 Essilfie-Taylor D2/947
D913,668 S 3/2021 Boys
D917,848 S 5/2021 Wehrmeyer
D922,741 S 6/2021 Boys
D922,742 S 6/2021 Boys
D929,097 S 8/2021 Winskowicz
D938,145 S 12/2021 Rezab
D940,443 S 1/2022 Papp
D948,853 S 4/2022 Jenkins
D950,211 S 5/2022 Tejada Bernard
D954,417 S * 6/2022 Bidal D2/954
D964,717 S * 9/2022 Mahoney D2/947
D973,337 S * 12/2022 Lesecq D2/962
D976,564 S 1/2023 Klug
D978,508 S 2/2023 Schneider
2002/0174567 A1 11/2002 Krafsur et al.
2003/0208929 A1 11/2003 Lucas et al.
2003/0233770 A1 12/2003 Foscaro
2004/0107601 A1 6/2004 Schmid
2004/0200097 A1* 10/2004 Boyd A43B 5/02 36/74
2005/0102858 A1 5/2005 Yen
2005/0126039 A1 6/2005 LeVert
2005/0166422 A1 8/2005 Schaeffer et al.
2005/0262739 A1 12/2005 McDonald
2006/0196084 A1* 9/2006 Kos A43B 1/0081 36/133
2007/0043630 A1 2/2007 Lyden
2007/0101617 A1 5/2007 Brewer et al.
2007/0240331 A1 10/2007 Borel
2007/0266593 A1 11/2007 Schindler et al.
2007/0271818 A1 11/2007 Rabushka
2008/0072462 A1 3/2008 Fusco
2008/0189982 A1 8/2008 Krafsur
2009/0100718 A1* 4/2009 Gerber .... A43C 15/04 36/67 A
2009/0183393 A1 7/2009 Lee
2009/0307925 A1 12/2009 Pfister
2010/0175280 A1 7/2010 Rinehart, Jr.
2010/0186261 A1 7/2010 Baker
2010/0218397 A1 9/2010 Nishiwaki et al.
2010/0263228 A1 10/2010 Kang
2011/0138652 A1 6/2011 Lucas
2012/0317835 A1 12/2012 Raysse et al.
2013/0192090 A1 8/2013 Smith
2014/0068966 A1 3/2014 Chaffin
2014/0101972 A1 4/2014 Ha
2014/0230280 A1 8/2014 Heard et al.
2014/0230283 A1* 8/2014 Cordova A43B 5/185 36/103
2014/0237852 A1 8/2014 Oberschneider et al.
2014/0245640 A1 9/2014 Heard et al.
2015/0047224 A1 2/2015 Zhao et al.
2015/0107132 A1 4/2015 Takeshita
2016/0262492 A1 9/2016 Fujita
2017/0079376 A1 3/2017 Bunnell et al.
2017/0105477 A1 4/2017 Wilkerson
2017/0150779 A1 6/2017 Walker et al.
2017/0245590 A1 8/2017 Kohatsu et al.
2018/0027922 A1 2/2018 Orand
2018/0035752 A1 2/2018 Walker et al.
2018/0042338 A1 2/2018 Orand
2018/0153254 A1 6/2018 Fusco et al.
2018/0168281 A1 6/2018 Case et al.
2018/0199666 A1 7/2018 Moriyasu et al.
2018/0199675 A1 7/2018 Cook et al.
2018/0235310 A1 8/2018 Wardlaw et al.
2018/0271215 A1 9/2018 Foxen
2018/0338568 A1 11/2018 Chambers et al.
2018/0352902 A1 12/2018 Wardle
2019/0082781 A1 3/2019 Iuchi et al.
2019/0150558 A1 5/2019 Shorten
2019/0150563 A1 5/2019 Shorten
2019/0159547 A1 5/2019 Nakatsuka
2019/0216169 A1 7/2019 Yahata
2019/0246738 A1 8/2019 Connell et al.
2019/0283355 A1 9/2019 Bartel et al.
2019/0289961 A1 9/2019 Iuchi et al.
2019/0320759 A1 10/2019 Conrad et al.
2019/0365030 A1 12/2019 Chambers et al.
2019/0365033 A1 12/2019 Chambers et al.
2019/0365034 A1 12/2019 Connell et al.
2019/0373982 A1 12/2019 Dupre et al.
2020/0008519 A1 1/2020 Farris et al.
2020/0046068 A1 2/2020 Choi et al.
2020/0100564 A1 4/2020 Bunnell et al.
2020/0121021 A1 4/2020 Bartel et al.
2020/0281322 A1 9/2020 Caldwell et al.
2020/0307134 A1* 10/2020 Yoshida A43B 13/04
2021/0015209 A1 1/2021 Buck
2021/0030112 A1 2/2021 Amoako et al.
2021/0052037 A1 2/2021 Greenspan
2021/0085024 A1 3/2021 Chen
2021/0368916 A1 12/2021 Wakasugi
2022/0015505 A1* 1/2022 Constantinou A43B 5/02

FOREIGN PATENT DOCUMENTS

CA 38477 S 12/1974
CA 70286 S 3/1992
CA 70821 S 6/1992
CA 79616 S 12/1996
CA 80237 S 3/1997
CA 80238 S 3/1997
CA 97079 S 5/2002
CA 97944 S 6/2003
CA 142281 S 4/2012
CA 145865 S 2/2013
CA 147979 S 12/2013
CA 148731 S 1/2014
CA 150008 S 1/2014
CA 151213 S 3/2014
CA 151413 S 4/2014
CA 151425 S 4/2014
CA 151434 S 4/2014
CA 155362 S 10/2014
CA 155411 S 11/2014
CA 155435 S 3/2015
CA 155436 S 3/2015
CA 159823 S 7/2015
CA 165390 S 6/2016
CA 169350 S 7/2017
CA 169349 S 1/2018
CN 2904704 Y 5/2007
CN 302004098 * 3/2012
CN 302004098 7/2012
CN 204132549 U 2/2015
CN 204467084 U 7/2015
DE 4015138 A1 11/1991
DE 102012104264 A1 11/2013
DE 102018122753 A1 3/2019
DE 102019107402 A1 9/2019
EP 1483981 A1 12/2004
EP 1346655 B1 8/2006
EP 1525284 B1 6/2007
EP 2138063 A1 12/2009
EP 2689681 A1 1/2014
EP 2491807 B1 10/2014
EP 1847193 B1 1/2015
EP 1386553 B1 6/2015
EP 2269478 B1 9/2015
EP 1690460 B1 8/2016
EP 1894484 B1 3/2018
EP 2979567 B1 10/2018
EP 3399882 A1 11/2018
EP 2911542 B1 12/2018
EP 3422893 A1 1/2019
EP 3434132 A1 1/2019
EP 3174419 B1 7/2019

EP	3574791	A1	12/2019
EP	2938218	B1	3/2020
EP	3331393	B1	4/2020
EP	3316721	B1	5/2020
EP	3457882	B1	6/2020
EP	3355738	B1	8/2020
EP	3689171	A1	8/2020
EP	3771358	A1	2/2021
FR	2827126	A1	1/2003
FR	2932963	B1	8/2010
FR	2993758	B1	3/2015
GB	2376408	A	12/2002
JP	D1732464	*	12/2022
KR	100844183	B1	7/2008
TW	D145320		2/2012
TW	D154740		7/2013
VN	30025397		12/2017
VN	30025398		12/2017
VN	30025399		12/2017
WO	9842221	A1	10/1998
WO	2000074515	A1	12/2000
WO	2007113595	A2	10/2007
WO	2008125716	A1	10/2008
WO	2011020798	A1	2/2011
WO	2013023163	A1	2/2013
WO	2016094714	A1	6/2016
WO	2017023532	A1	2/2017
WO	2017120006	A1	7/2017
WO	2017151501	A1	9/2017
WO	2019157244	A1	8/2019
WO	2021016163	A1	1/2021

OTHER PUBLICATIONS

[Adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https://www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/B0119E37WS/ref=cm_cr_arp_d_product_top?ie=UTF8 (Year: 2015).*

[Puma EvoSpeed Sprint 14], announced on YouTube on Jan. 5, 2023 [online], [site visited May 5, 2023], Available from the internet URL: PUMA evoSpeed Sprint 14 SKU: 9787857 (Year: 2023).*

International Search Report of International Application No. PCT/IB2021/062487, mailed Mar. 30, 2022, 7 pages.

Written Opinion of International Application No. PCT/IB2021/062487, mailed Mar. 30, 2022, 7 pages.

[adidas Adizero], available on Amazon.com, Nov. 23, 2015 [online], [May 5, 2023], Available from the internet URL: https://www.amazon.com/adidas-Adizero-Prime-Collegiate-White/dp/BO119E37WS/ref=cm_cr_arp_d_product_topie=UTFS (Year: 2015).

* cited by examiner

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Assistant Examiner — Adrienne Corna
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

(57) **CLAIM**

The ornamental design for a shoe, as shown and described.

DESCRIPTION

FIG. **1** is a top, right, and front perspective view of an ornamental design for a shoe;
FIG. **2** is a left side elevational view of the shoe of FIG. **1**;
FIG. **3** is a right side elevational view of the shoe of FIG. **1**; and,
FIG. **4** is a bottom plan view of the shoe of FIG. **1**.

The dash-dash-dash broken lines are included for the purpose of illustrating portions of the shoe that form no part of the claimed design. A transition in tonal contrast shown along the front cushion is claimed.

1 Claim, 4 Drawing Sheets

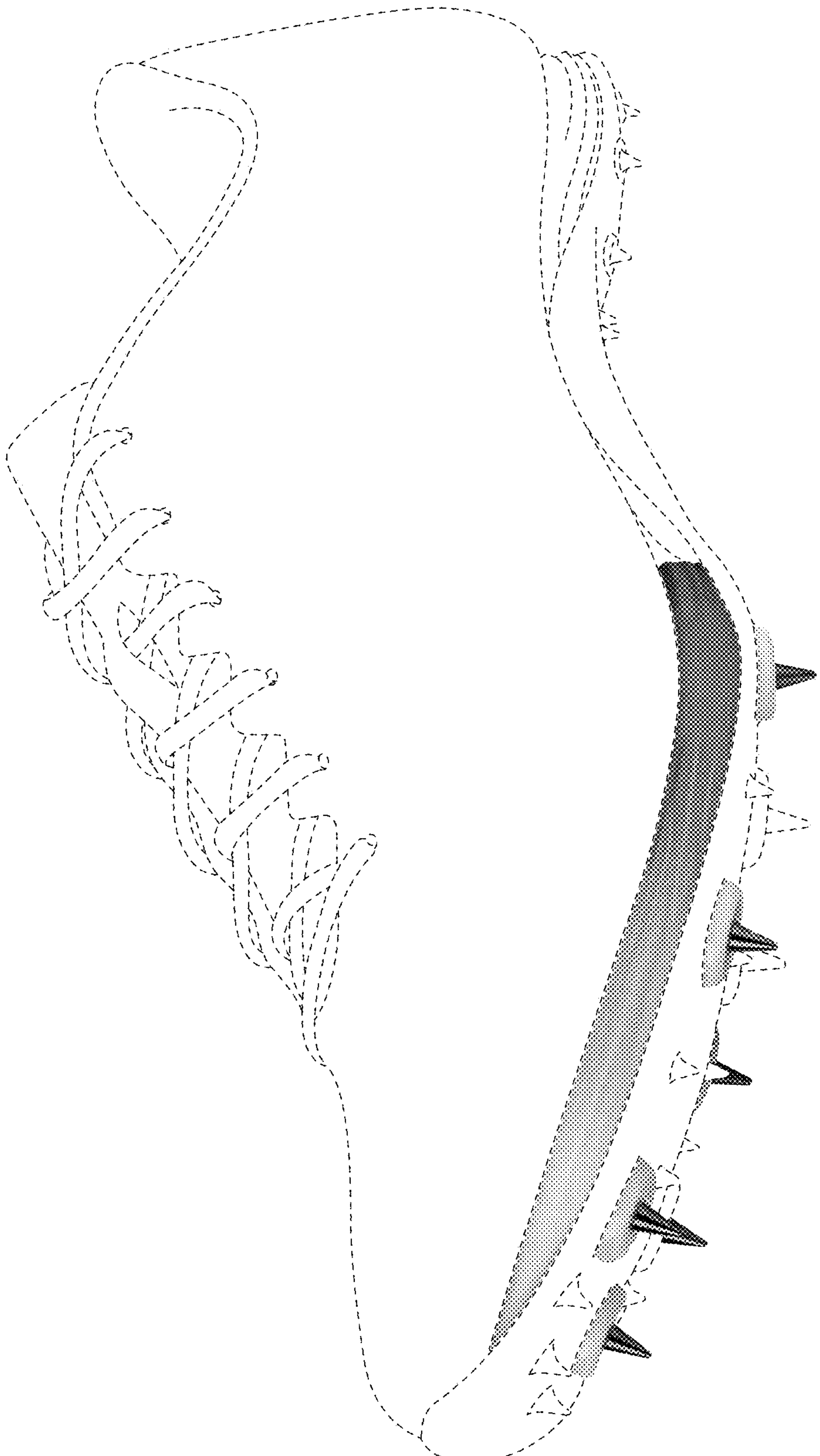

FIG. 1

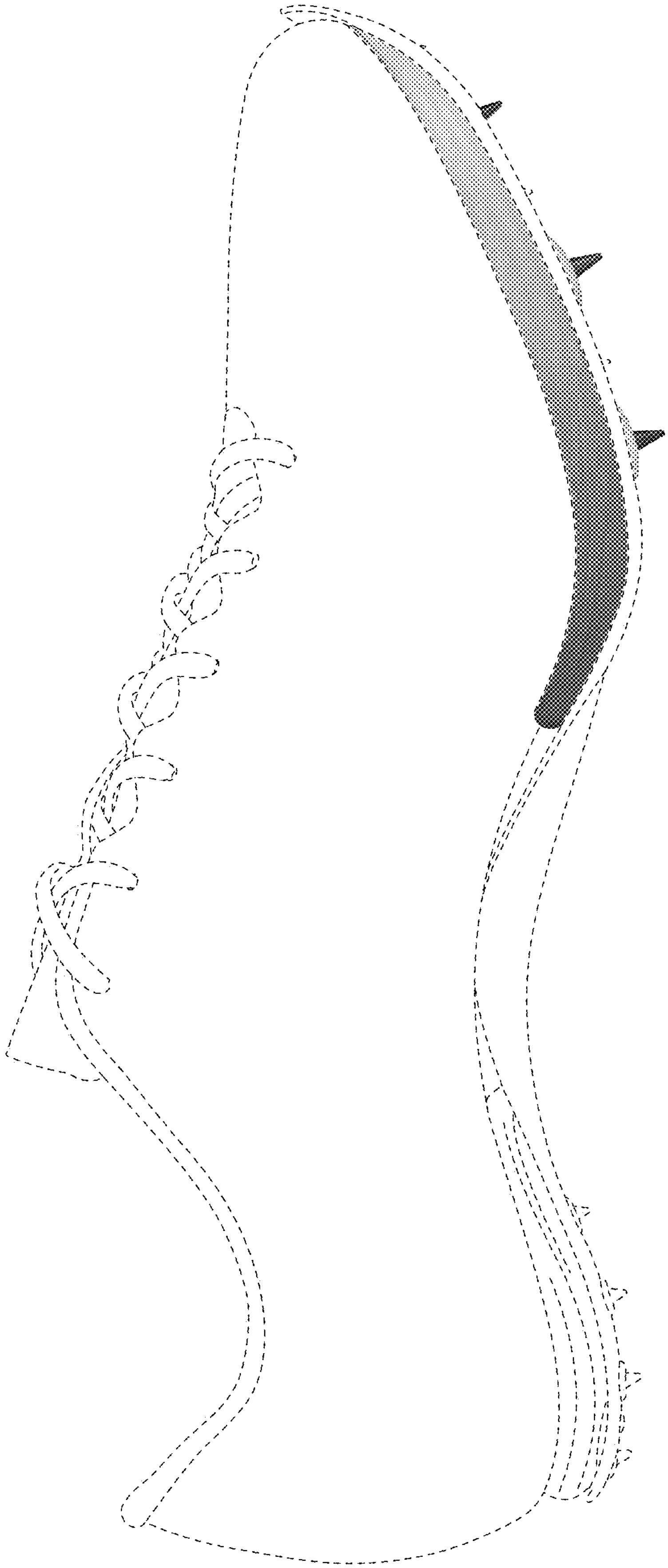

FIG. 2

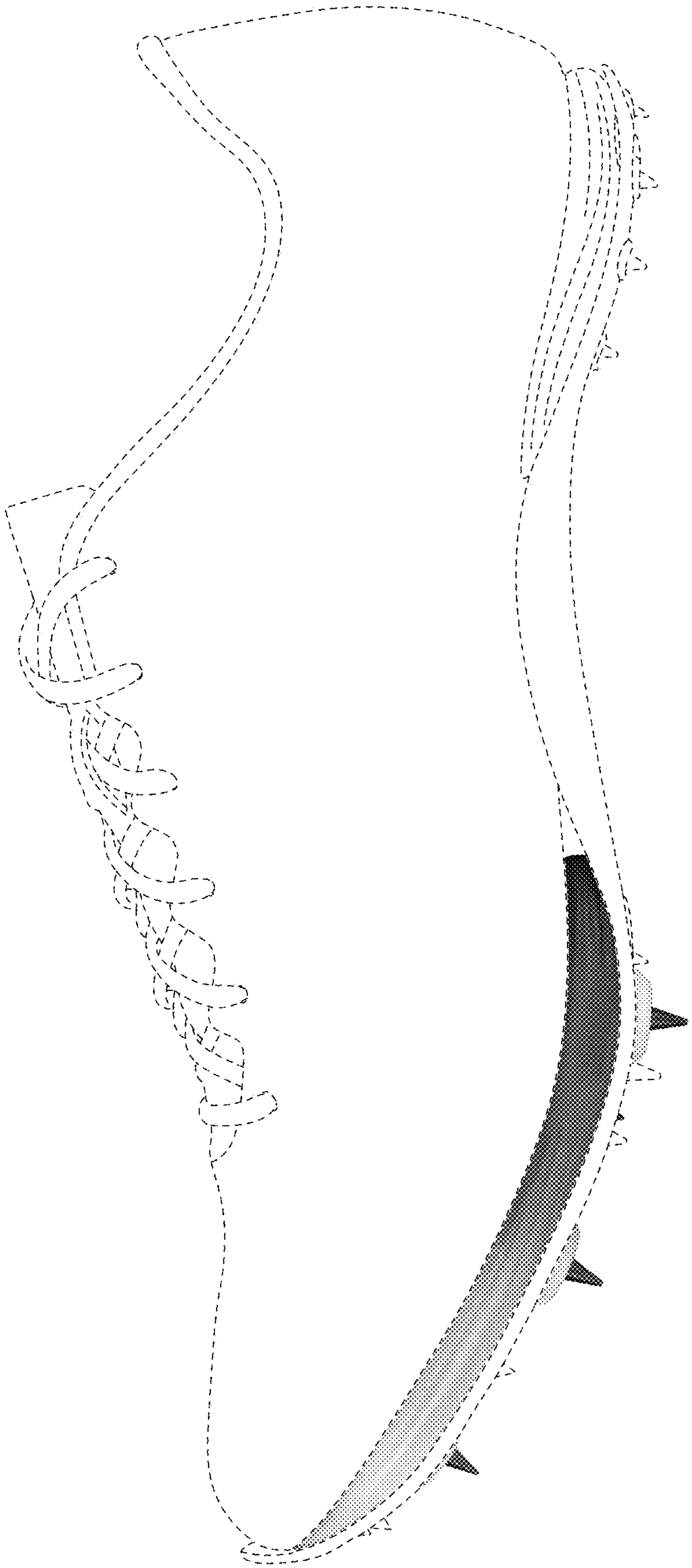

FIG. 3

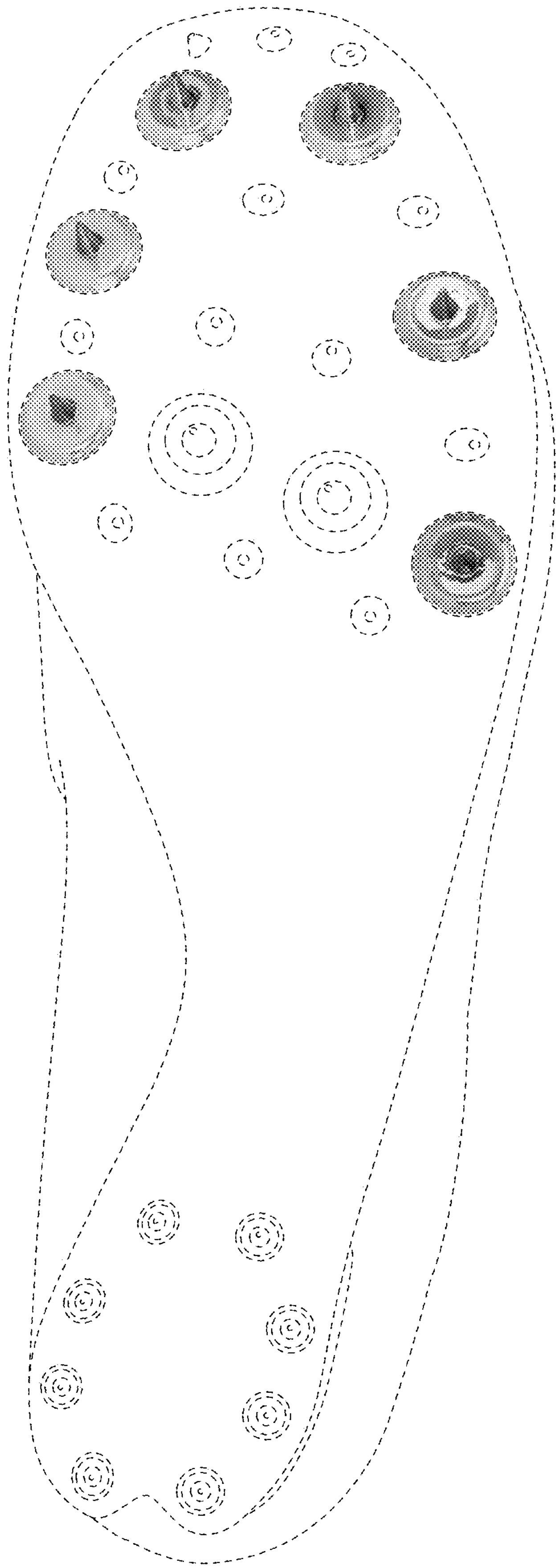

FIG. 4

EXHIBIT H

US0D1021356S

(12) **United States Design Patent**
Vella

(10) **Patent No.: US D1,021,356 S**
(45) **Date of Patent: ** *Apr. 9, 2024**

(54) **SHOE**

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(*) Notice: This patent is subject to a terminal disclaimer.

(**) Term: **15 Years**

(21) Appl. No.: **29/891,909**

(22) Filed: **May 11, 2023**

Related U.S. Application Data

(63) Continuation of application No. 29/808,577, filed on Sep. 21, 2021.

(51) **LOC (14) Cl.** **02-04**

(52) **U.S. Cl.**
USPC **D2/977**; D2/947; D2/902

(58) **Field of Classification Search**
USPC D2/902, 906, 908, 916, 918, 925, 943, D2/946–962, 972, 977
CPC A43B 13/00; A43B 13/02; A43B 13/20; A43B 13/22; A43B 13/24; A43B 13/28; A43B 13/30; A43B 13/32; A43B 13/34; A43B 13/36; A43B 13/023; A43B 13/026; A43B 13/04; A43B 13/08; A43B 13/10; A43B 13/12; A43B 13/141; A43B 13/143; A43B 13/16; A43B 13/18; A43B 13/181; A43B 13/187; A43B 13/189; A43B 13/223
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

D327,165 S	6/1992	Hatfield
D350,638 S	9/1994	Yoshikawa
D377,411 S	1/1997	Murray
D378,472 S	3/1997	Bramani
D401,741 S	12/1998	Clarke
D415,607 S	10/1999	Merceron
D423,201 S	4/2000	Wilson
D454,426 S	3/2002	Wilson

(Continued)

FOREIGN PATENT DOCUMENTS

CA	70286 S	3/1992
CA	70821 S	6/1992

(Continued)

OTHER PUBLICATIONS

[Saucony Endorphin Shift 3], available on heartbreak.run, [site visited Aug. 7, 2023], Internet URL: https://heartbreak.run/products/saucony-womens-endorphin-shift-3-shoe (Year: 2023).*

(Continued)

Primary Examiner — Jennifer L Rempfer
Assistant Examiner — Adrienne Corna
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

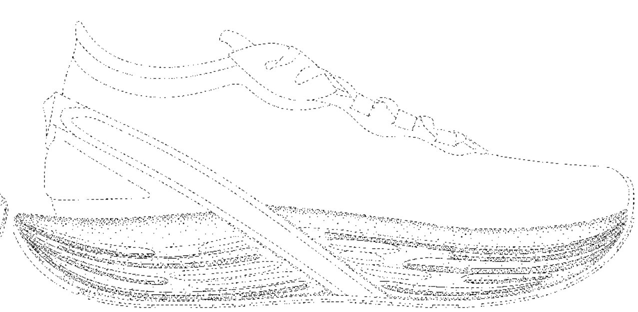
(57) **CLAIM**

The ornamental design for a shoe, as shown and described.

DESCRIPTION

FIG. **1** is a top, left, and front perspective view of an ornamental design for a shoe;
FIG. **2** is a left side elevational view of the shoe of FIG. **1**;
FIG. **3** is a right side elevational view of the shoe of FIG. **1**; and,
FIG. **4** is a front elevational view of the shoe of FIG. **1**.
The dash-dash-dash broken lines are included for the purpose of illustrating portions of the shoe that form no part of the claimed design.

1 Claim, 4 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

D473,042	S		4/2003	Wilson	
D473,047	S		4/2003	Wilson	
D476,800	S		7/2003	Fuerst	
D498,901	S		11/2004	Hawker	
D507,398	S		7/2005	Recchi	
D511,617	S		11/2005	Matis	
D615,738	S		5/2010	Teteriatnikov	
D637,803	S		5/2011	Alvear	
D643,189	S	*	8/2011	Teteriatnikov	D2/977
D666,795	S	*	9/2012	Shaffer	D2/947
D672,123	S		12/2012	Williams, Jr.	
D680,308	S	*	4/2013	Hardman	D2/947
D685,166	S		7/2013	Hatfield	
D690,088	S		9/2013	Hardman	
D692,217	S		10/2013	Fogg	
D694,497	S	*	12/2013	Taylor	D2/947
D694,498	S		12/2013	Carboy	
D694,499	S	*	12/2013	Williams, Jr.	D2/947
D710,579	S		8/2014	Williams, Jr.	
D713,625	S		9/2014	Raasch	
D713,626	S		9/2014	Raasch	
D714,035	S		9/2014	O'Connor	
D731,767	S	*	6/2015	Lan	D2/947
D743,153	S		11/2015	Taylor	
D746,560	S		1/2016	Verfl	
D747,083	S		1/2016	Verfl	
D756,620	S		5/2016	Boys	
D768,969	S		10/2016	Boys	
D770,739	S		11/2016	Nethongkome	
D770,740	S		11/2016	Teteriatnikov	
D779,175	S		2/2017	Greenhalgh	
D782,790	S		4/2017	Lee	
D789,054	S		6/2017	Shyllon	
D790,169	S		6/2017	da Costa Pereira Machado	
D790,183	S		6/2017	VanHook	
D791,453	S		7/2017	McMillan	
D793,046	S		8/2017	Lee	
D795,541	S		8/2017	Henrichot	
D796,168	S		9/2017	Shyllon	
D796,799	S	*	9/2017	Shyllon	D2/947
D798,551	S		10/2017	Shyllon	
D798,554	S		10/2017	Swierszczk	
D798,555	S		10/2017	Enayah	
D798,558	S		10/2017	Pauk	
D810,411	S		2/2018	Klein	
D812,871	S		3/2018	Reyes	
D815,816	S		4/2018	Cin	
D815,817	S		4/2018	Cin	
D815,818	S		4/2018	Cin	
D815,820	S		4/2018	Cin	
D815,821	S		4/2018	Cin	
D815,822	S		4/2018	Cin	
D815,823	S		4/2018	Cin	
D816,310	S		5/2018	Cooper	
D816,311	S		5/2018	Cin	
D816,959	S		5/2018	Cin	
D816,960	S		5/2018	Cin	
D817,614	S		5/2018	Cin	
D817,615	S		5/2018	Cin	
D817,616	S		5/2018	Cin	
D834,795	S	*	12/2018	Vasyli	D2/947
D847,478	S		5/2019	Fracassi	
D853,097	S		7/2019	Cass	
D853,701	S		7/2019	Hong	
D855,301	S	*	8/2019	Williams, Jr.	D2/947
D862,046	S		10/2019	Page	
D870,429	S		12/2019	Becker	
D874,098	S	*	2/2020	Hartmann	D2/902
D882,918	S		5/2020	Kosenick	
D885,718	S		6/2020	Roulo	
D889,798	S		7/2020	Vella	
D890,484	S	*	7/2020	Williams, Jr.	D2/947
D907,903	S	*	1/2021	Garcia	D2/947
D912,947	S		3/2021	Boys	
D912,948	S		3/2021	Boys	
D913,655	S		3/2021	Boys	
D913,668	S		3/2021	Boys	
D917,848	S		5/2021	Wehrmeyer	
D922,741	S		6/2021	Boys	
D922,742	S		6/2021	Boys	
D929,097	S		8/2021	Winskowicz	
D938,145	S		12/2021	Rezab	
D940,443	S		1/2022	Papp	
D948,853	S		4/2022	Jenkins	
D950,211	S		5/2022	Tejada Bernard	
D976,564	S		1/2023	Klug	
D978,508	S		2/2023	Schneider	
D992,258	S	*	7/2023	Raleigh	D2/947

FOREIGN PATENT DOCUMENTS

CA	97079	S		5/2002
CA	97944	S		6/2003
CA	142281	S		4/2012
CA	145865	S		2/2013
CA	147979	S		12/2013
CA	148731	S		1/2014
CA	150008	S		1/2014
CA	151213	S		3/2014
CA	151413	S		4/2014
CA	151425	S		4/2014
CA	151434	S		4/2014
CA	155362	S		10/2014
CA	155411	S		11/2014
CA	155435	S		3/2015
CA	155436	S		3/2015
CA	159823	S		7/2015
CA	165390	S		6/2016
CA	169350	S		7/2017
CA	169349	S		1/2018
EM	015026166-0001		*	6/2023
TW	145320	S		2/2012
TW	154740	S		7/2013
VN	30025397	S1		12/2017
VN	30025398	S1		12/2017
VN	30025399	S1		12/2017

OTHER PUBLICATIONS

[Puma Run XX Nitro Review], available on doctorsofrunning.com, [site visited Aug. 7, 2023], Internet URL: https://www.doctorsofrunning.com/2022/07/puma-run-xx-nitro-review-2022.html (Year: 2022).*

* cited by examiner

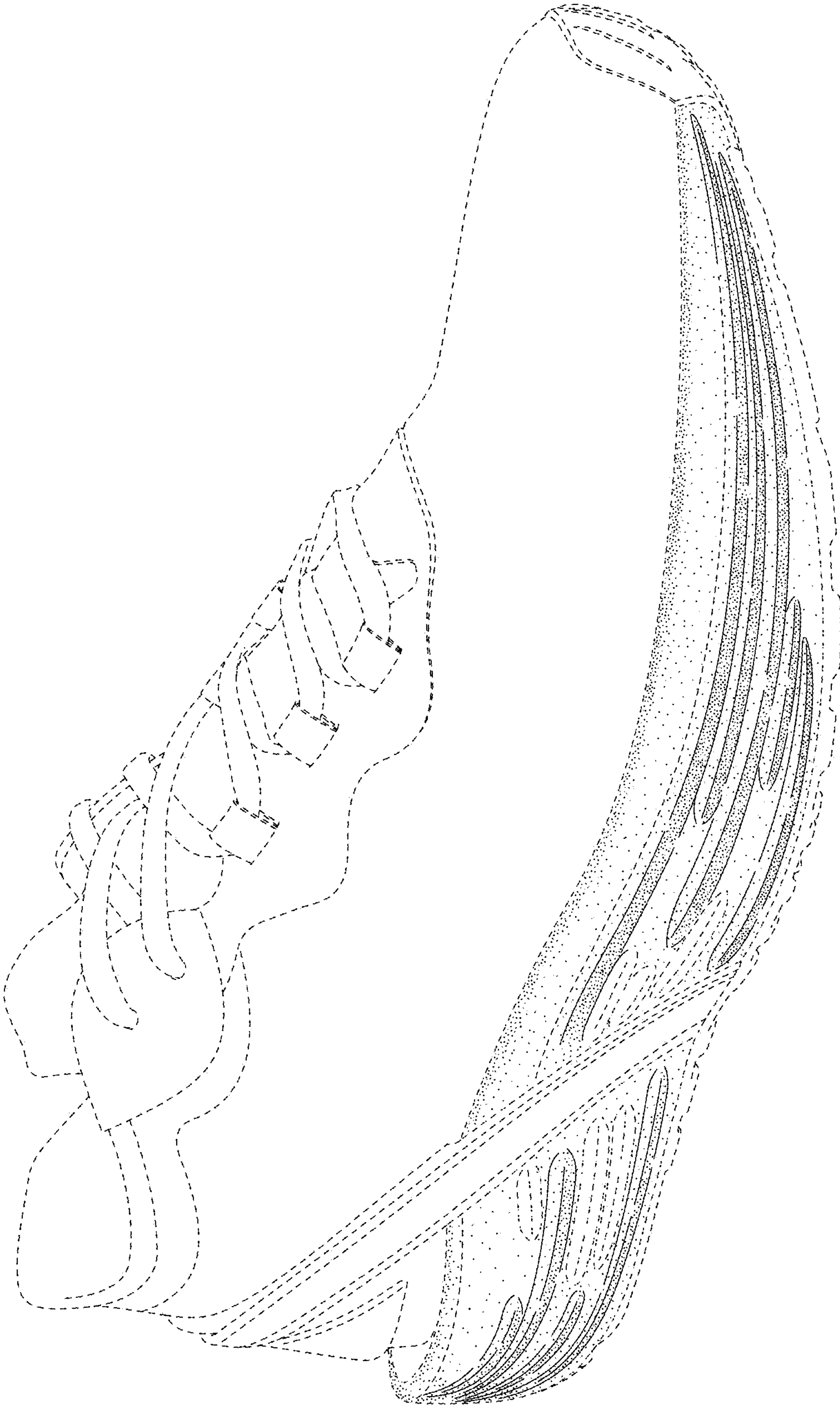


FIG. 1

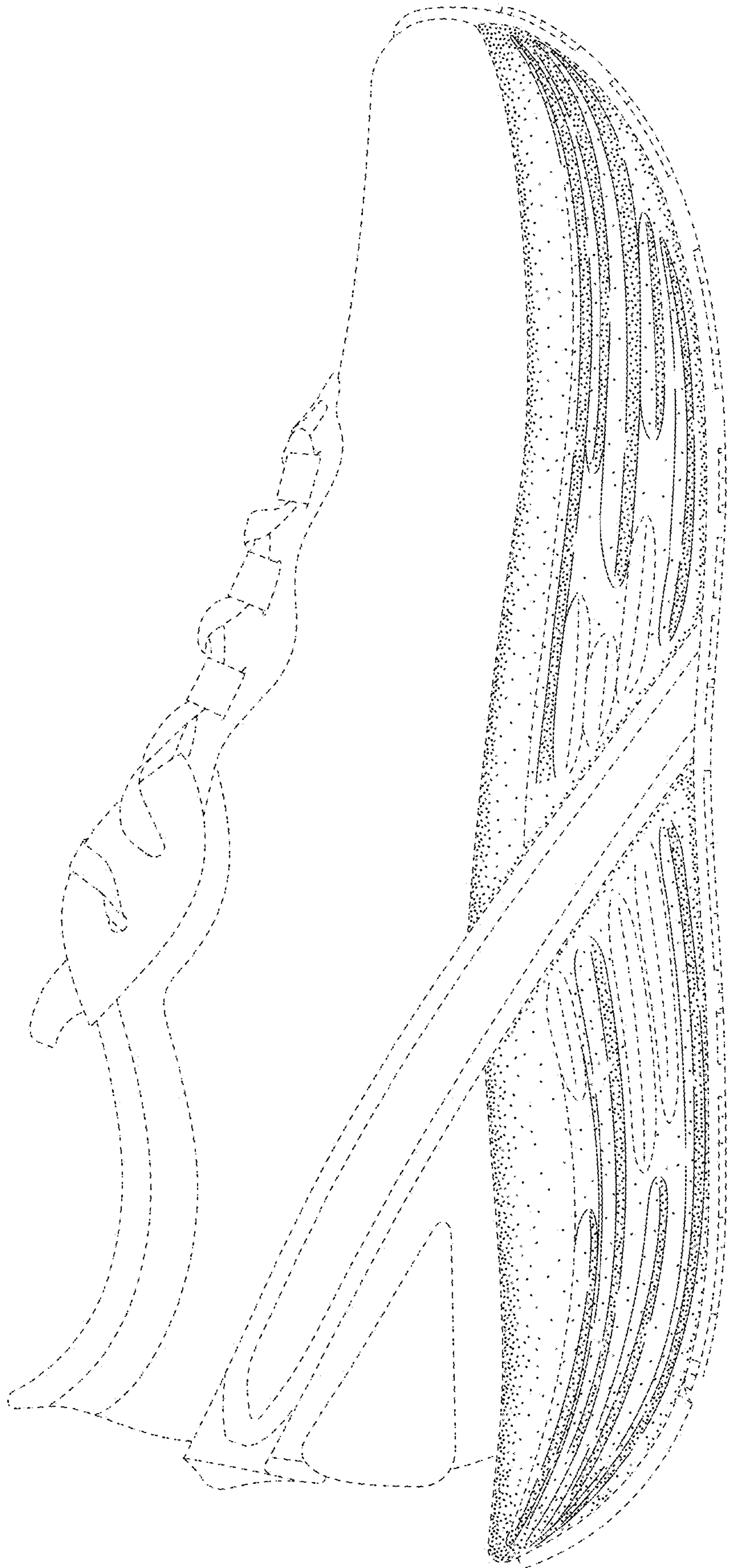


FIG. 2

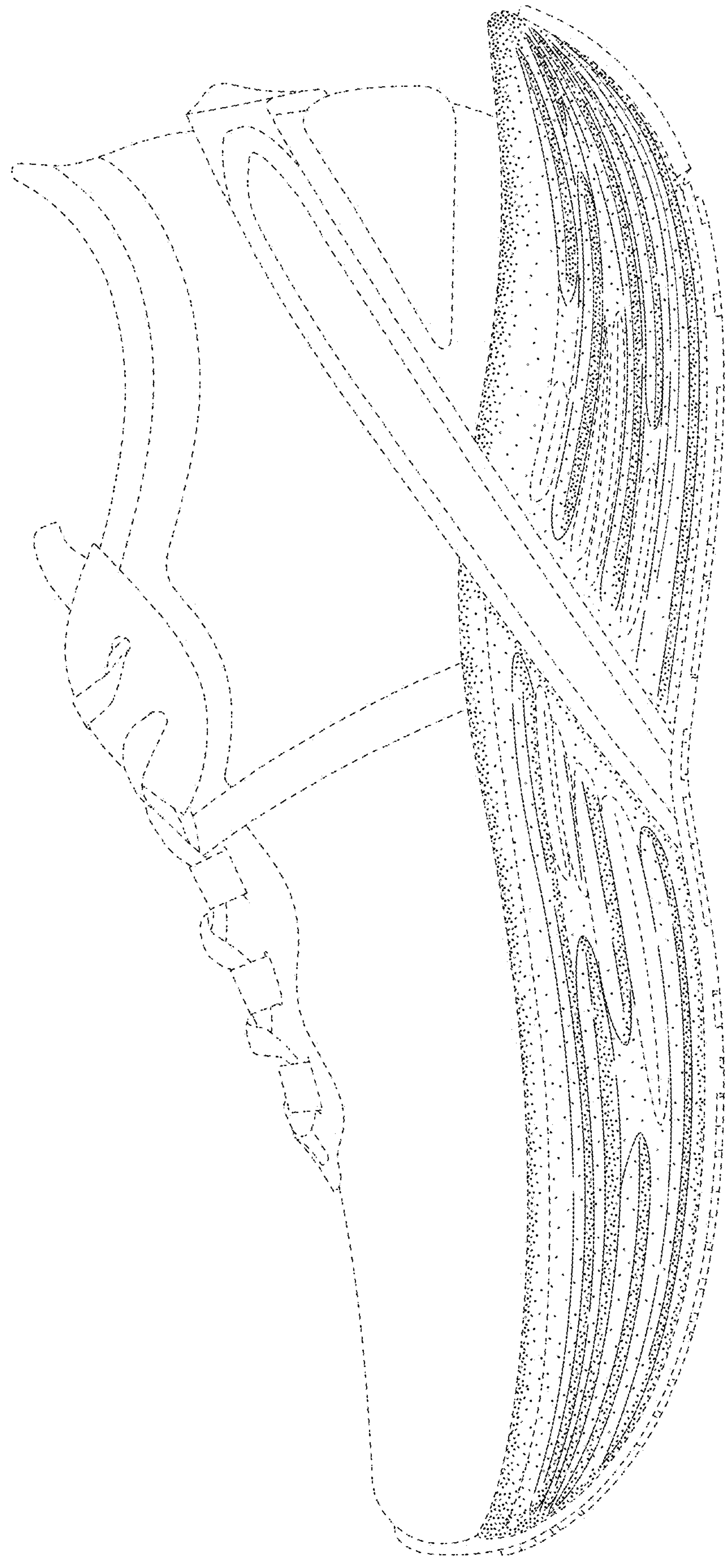


FIG. 3

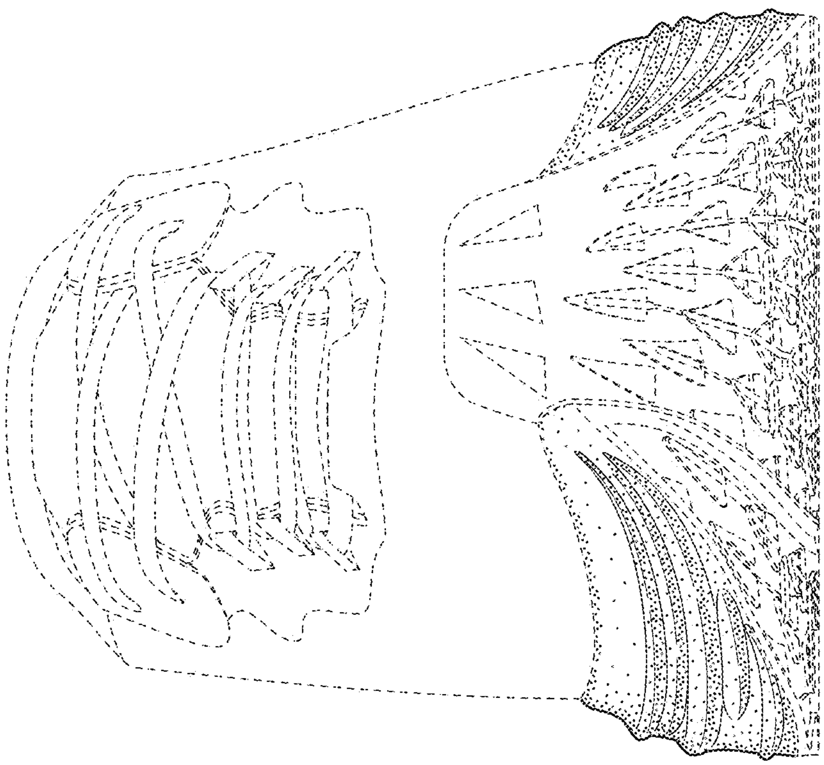


FIG. 4

EXHIBIT I

US0D1009432S

(12) **United States Design Patent** (10) **Patent No.: US D1,009,432 S**
Siegismund et al. (45) **Date of Patent: ** Jan. 2, 2024**

(54) **SHOE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

(72) Inventors: **Andreas Siegismund**, Rückersdorf (DE); **Romain Girard**, Lauf an der Pegnitz (DE)

(73) Assignee: **PUMA SE**, Herzogenaurach (DE)

(**) Term: **15 Years**

(21) Appl. No.: **29/892,741**

(22) Filed: **May 22, 2023**

Related U.S. Application Data

(63) Continuation of application No. 29/891,899, filed on May 11, 2023, which is a continuation of application No. 29/760,391, filed on Dec. 1, 2020.

(51) **LOC (14) Cl.** **02-04**

(52) **U.S. Cl.**
USPC **D2/947**

(58) **Field of Classification Search**
USPC D2/896, 900, 902, 904, 906–908, D2/916–924, 925–945, 947–960, 969–979
CPC A43B 1/00; A43B 1/02; A43B 1/04; A43B 3/00; A43B 3/02; A43B 3/06; A43B 3/10; A43B 3/12; A43B 3/14; A43B 5/00; A43B 5/001; A43B 5/008; A43B 5/06; A43B 5/10; A43B 5/12; A43B 23/00; A43B 23/02; A43B 23/04
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

D266,798 S	*	11/1982	Famolare, Jr.	D2/950
D327,165 S		6/1992	Hatfield	
D350,638 S		9/1994	Yoshikawa	
D364,728 S		12/1995	Nozu	
D366,354 S		1/1996	Yoshikawa	
D377,411 S		1/1997	Murray	
D378,472 S		3/1997	Bramani	
D395,341 S	*	6/1998	Greenberg	D2/957
D401,741 S		12/1998	Clarke	
D410,691 S		6/1999	Boyer	
D414,023 S		9/1999	Cretinon	
D415,607 S		10/1999	Merceron	

(Continued)

FOREIGN PATENT DOCUMENTS

CA	70286 S	3/1992
CA	70821 S	6/1992

(Continued)

OTHER PUBLICATIONS

Best Puma Running Shoes of 2023_ What We Know, posted Jan. 3, 2023 [online], [retrieved Aug. 16, 2023]. Retrieved from internet, https://believeintherun.com/shoe-reviews/best-puma-running-shoes-of-2023/ (Year: 2023).*

(Continued)

Primary Examiner — Jonathan J Han
Assistant Examiner — Christen Pilar Brown
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

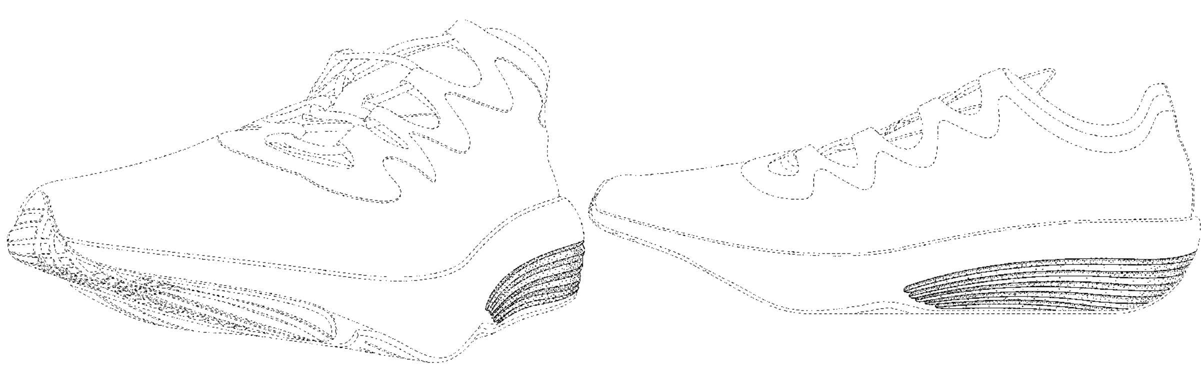
(57) **CLAIM**

The ornamental design for a shoe, as shown and described.

DESCRIPTION

FIG. **1** is a top, right, front perspective view of an ornamental design for a shoe; and,
FIG. **2** is a right side elevational view of the shoe of FIG. **1**.
The dash-dash-dash broken lines are included for the purpose of illustrating portions of the shoe that form no part of the claimed design.

1 Claim, 2 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

D423,201	S		4/2000	Wilson	
D433,214	S		11/2000	McDowell	
D433,791	S		11/2000	Laberge	
D436,718	S		1/2001	Patterson	
D439,031	S		3/2001	Matis	
D450,439	S		11/2001	Wilson	
D454,426	S		3/2002	Wilson	
D459,864	S		7/2002	Butler	
D466,278	S	*	12/2002	Smith, III	D2/977
D473,042	S		4/2003	Wilson	
D473,047	S		4/2003	Wilson	
D473,697	S		4/2003	Gillespie	
D476,800	S		7/2003	Fuerst	
D498,901	S		11/2004	Hawker	
D507,398	S		7/2005	Recchi	
D511,617	S		11/2005	Matis	
D528,751	S		9/2006	Pawlus	
D530,491	S		10/2006	Sonnergren	
D546,035	S		7/2007	Belley	
D554,831	S		11/2007	Lotti	
D557,481	S		12/2007	Hui	
D565,283	S		4/2008	Smith	
D576,393	S	*	9/2008	Kaufman	D2/947
D579,636	S		11/2008	Graber	
D592,383	S		5/2009	Wawrousek	
D615,738	S		5/2010	Teteriatnikov	
D624,735	S		10/2010	Raysse	
D626,315	S		11/2010	Teteriatnikov	
D634,918	S	*	3/2011	Katz	D2/943
D637,803	S		5/2011	Alvear	
D643,189	S	*	8/2011	Teteriatnikov	D2/977
D662,698	S	*	7/2012	Pulli	D2/947
D666,795	S		9/2012	Shaffer	
D671,723	S	*	12/2012	Teteriatnikov	D2/947
D672,123	S		12/2012	Williams, Jr.	
D677,040	S		3/2013	Vestuti	
D677,866	S		3/2013	Vestuti	
D680,308	S		4/2013	Hardman	
D685,166	S		7/2013	Hatfield	
D690,088	S		9/2013	Hardman	
D692,217	S		10/2013	Fogg	
D694,498	S		12/2013	Carboy	
D694,499	S		12/2013	Williams, Jr.	
8,607,474	B2	*	12/2013	Spanks	B29D 35/126 36/4
D696,852	S	*	1/2014	Madore	D2/972
D697,293	S		1/2014	Vestuti	
D710,579	S		8/2014	Williams, Jr.	
D713,625	S		9/2014	Raasch	
D713,626	S		9/2014	Raasch	
D714,035	S		9/2014	O'Connor	
D731,767	S		6/2015	Lan	
D737,040	S	*	8/2015	Pauk	D2/972
D742,107	S	*	11/2015	Kasprzak	D2/951
D743,153	S		11/2015	Taylor	
D746,560	S		1/2016	Verfl	
D747,083	S		1/2016	Verfl	
D756,620	S		5/2016	Boys	
D768,969	S		10/2016	Boys	
D770,739	S		11/2016	Nethongkome	
D770,740	S		11/2016	Teteriatnikov	
D777,413	S		1/2017	Hermes	
D779,175	S		2/2017	Greenhalgh	
D781,541	S	*	3/2017	McGhee	D2/947
D781,542	S	*	3/2017	McGhee	D2/947
D782,790	S		4/2017	Lee	
D784,671	S		4/2017	Little	
D789,054	S		6/2017	Shyllon	
D790,169	S		6/2017	da Costa Pereira Machado	
D790,183	S		6/2017	VanHook	
D791,453	S		7/2017	McMillan	
D793,046	S		8/2017	Lee	
D795,541	S		8/2017	Henrichot	
D796,168	S		9/2017	Shyllon	
D796,799	S		9/2017	Shyllon	
D798,551	S		10/2017	Shyllon	
D798,554	S		10/2017	Swierszczk	
D798,555	S		10/2017	Enayah	
D798,558	S		10/2017	Pauk	
D810,411	S		2/2018	Klein	
D812,871	S		3/2018	Reyes	
D815,816	S		4/2018	Cin	
D815,817	S		4/2018	Cin	
D815,818	S		4/2018	Cin	
D815,820	S		4/2018	Cin	
D815,821	S		4/2018	Cin	
D815,822	S		4/2018	Cin	
D815,823	S		4/2018	Cin	
D816,310	S		5/2018	Cooper	
D816,311	S		5/2018	Cin	
D816,959	S		5/2018	Cin	
D816,960	S		5/2018	Cin	
D817,614	S		5/2018	Cin	
D817,615	S		5/2018	Cin	
D817,616	S		5/2018	Cin	
D834,795	S	*	12/2018	Vasyli	D2/947
D847,478	S		5/2019	Fracassi	
D853,097	S		7/2019	Cass	
D853,701	S		7/2019	Hong	
D855,301	S		8/2019	Williams, Jr.	
D862,046	S		10/2019	Page	
D866,932	S		11/2019	Verfl	
D870,429	S		12/2019	Becker	
D882,918	S		5/2020	Kosenick	
D885,718	S		6/2020	Roulo	
D889,798	S		7/2020	Vella	
D891,059	S		7/2020	Shyllon	
D893,148	S		8/2020	de Montgolfier	
D893,154	S		8/2020	de Montgolfier	
D894,574	S		9/2020	de Montgolfier	
D912,947	S		3/2021	Boys	
D912,948	S		3/2021	Boys	
D913,655	S		3/2021	Boys	
D913,668	S		3/2021	Boys	
D917,848	S		5/2021	Wehrmeyer	
D922,741	S		6/2021	Boys	
D922,742	S		6/2021	Boys	
D929,097	S		8/2021	Winskowicz	
D938,145	S		12/2021	Rezab	
D940,443	S		1/2022	Papp	
D948,853	S		4/2022	Jenkins	
D950,211	S		5/2022	Tejada Bernard	
D950,212	S	*	5/2022	Tejada Bernard	D2/947
D976,564	S		1/2023	Klug	
D978,508	S		2/2023	Schneider	
2011/0225852	A1	*	9/2011	Mahoney	A43B 13/12 36/30 R
2014/0150298	A1	*	6/2014	Crowley	A43B 7/144 36/103
2014/0259788	A1	*	9/2014	Dojan	A43B 13/186 36/103
2014/0259789	A1	*	9/2014	Dojan	A43B 13/127 36/103
2017/0150777	A1	*	6/2017	Youngs	A43B 7/20
2017/0208896	A1	*	7/2017	Mokos	A43B 23/0235
2022/0022595	A1		1/2022	Girard	

FOREIGN PATENT DOCUMENTS

CA	97079	S	5/2002
CA	97944	S	6/2003
CA	142281	S	4/2012
CA	145865	S	2/2013
CA	147979	S	12/2013
CA	148731	S	1/2014
CA	150008	S	1/2014
CA	151213	S	3/2014
CA	151413	S	4/2014
CA	151425	S	4/2014
CA	151434	S	4/2014
CA	155362	S	10/2014
CA	155411	S	11/2014
CA	155435	S	3/2015

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

CA	155436	S	3/2015
CA	159823	S	7/2015
CA	165390	S	6/2016
CA	169350	S	7/2017
CA	169349	S	1/2018
TW	145320	S	2/2012
TW	154740	S	7/2013
VN	30025397	S1	12/2017
VN	30025398	S1	12/2017
VN	30025399	S1	12/2017

OTHER PUBLICATIONS

Adidas Black Suede Runner, posted Feb. 25, 2016 [online]. [Retrieved Oct. 3, 2022]. Retrieved from internet, https://www.grailed.com/listings/3862243-adidas-x-rick-owens-black-suede-runner (Oct. 3, 2022), 5 pages.

Deviate Nitro 2 Womens Running Shoes, posted 2022 [online], [Retrieved Sep. 29, 2022]. Retrieved from internet, https://us.puma.com/us/en/pd/deviate-nitro-2-womens-running-shoes/376855swatch=04 (Sep. 29, 2022), 3 pages.

Pwrframe Mens Training Shoes, posted 2022 [online], [Retrieved Sep. 29, 2022]. Retrieved from internet, https://us.puma.com/us/en/pd/pwrframe-mens-training-shoes/376049swatch=08 (Sep. 29, 2022), 4 pages.

Velocity Nitro WTR Womens Running Shoes, posted 2022 [online], [Retrieved Sep. 29, 2022]. Retrieved from internet, https:// us.puma.com/us/en/pd/velocity-nitro-wtr-womens-running-shoes/195296swatch=01 (Sep. 29, 2022), 5 pages.

* cited by examiner

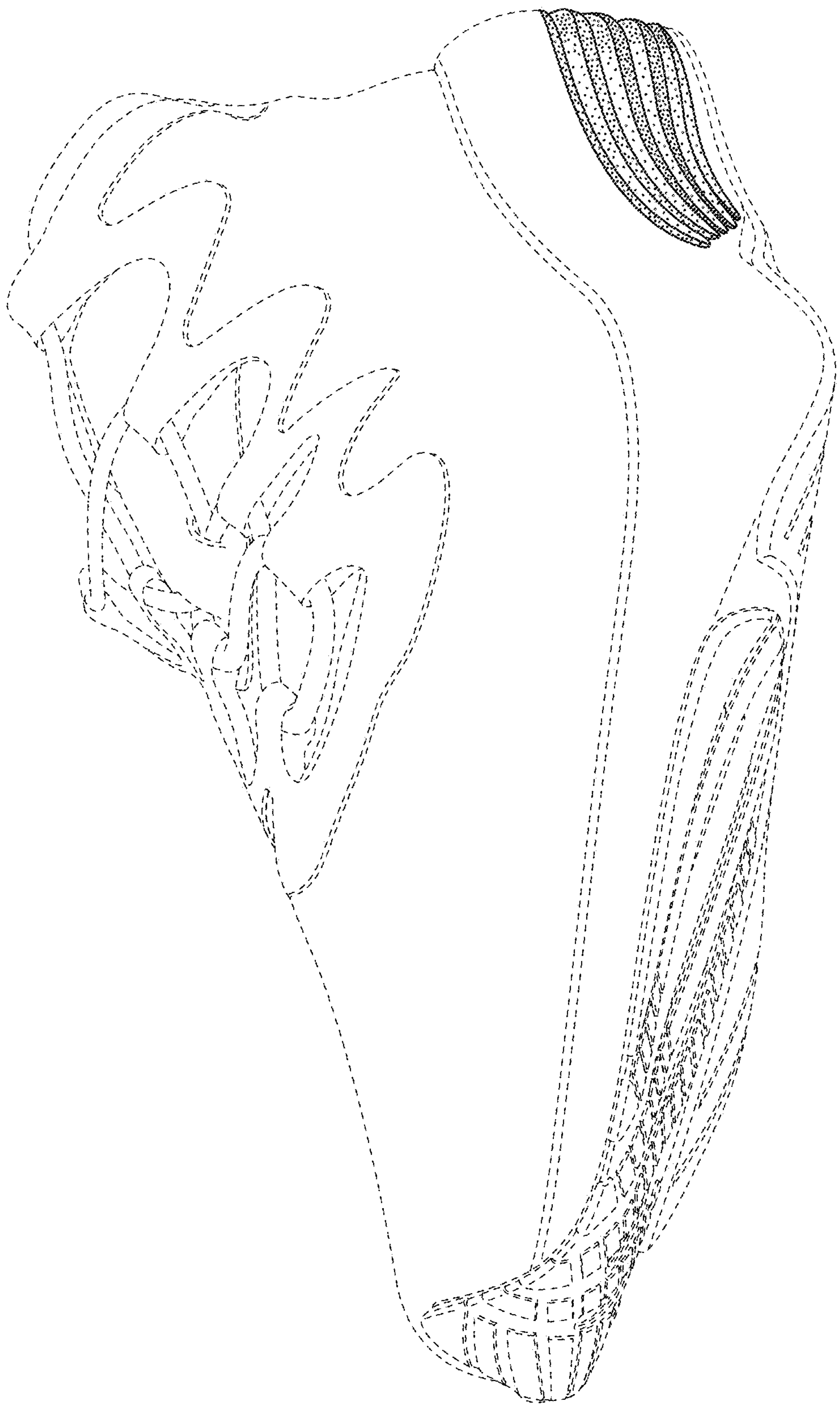


FIG. 1

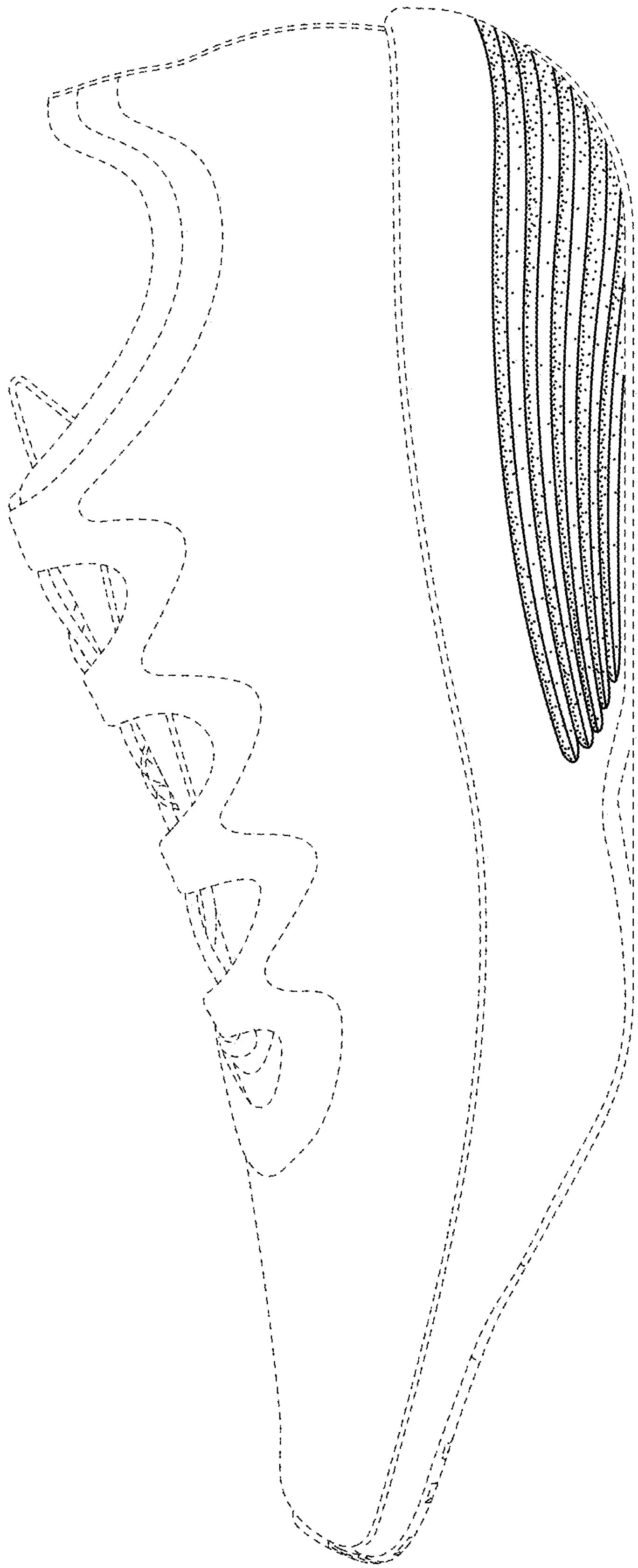


FIG. 2

EXHIBIT J

US012096816B2

(12) **United States Patent**
Girard et al.

(10) **Patent No.: US 12,096,816 B2**
(45) **Date of Patent: Sep. 24, 2024**

(54) **ARTICLE OF FOOTWEAR HAVING A SOLE PLATE**

(71) Applicant: **PUMA SE**, Herzogenaurach (DE)

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(73) Assignee: **PUMA SE**, Herzogenaurach (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/235,473**

(22) Filed: **Aug. 18, 2023**

(65) **Prior Publication Data**

US 2024/0251908 A1 Aug. 1, 2024

Related U.S. Application Data

(63) Continuation of application No. 18/101,992, filed on Jan. 26, 2023, now Pat. No. 12,016,422, which is a (Continued)

(51) **Int. Cl.**
A43B 13/12 (2006.01)
A43B 13/02 (2022.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A43B 13/122*** (2013.01); ***A43B 13/127*** (2013.01); ***A43B 13/145*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ... A43B 13/122; A43B 13/127; A43B 13/145; A43B 13/37; A43B 13/026; A43B 13/04
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,611,152 A 3/1997 Richard
6,151,806 A * 11/2000 Morris A43B 5/00 36/107

(Continued)

FOREIGN PATENT DOCUMENTS

CN 101611953 U 12/2009
CN 202145942 U 2/2012

(Continued)

OTHER PUBLICATIONS

European Search Report from corresponding European Patent Application No. 21 187 302.1 dated Dec. 8, 2021 (9 pages).

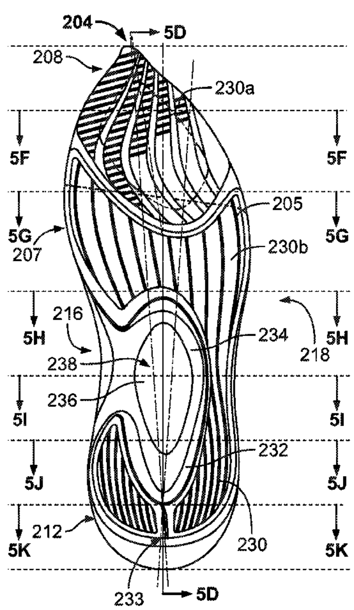
(Continued)

Primary Examiner — Bao-Thieu L Nguyen
(74) *Attorney, Agent, or Firm* — Quarles & Brady LLP

(57) **ABSTRACT**

A sole structure for an article of footwear having an upper includes an outsole having a ground engaging surface and a midsole member disposed between the outsole and the upper. The midsole member has a pocket extending from a heel region to a forefoot region and a sole plate disposed within the pocket. The sole plate extends from the heel region into the forefoot region. In the heel region, the sole structure is shaped to define an entry region that is configured to increase contact at the ground engaging surface during a heel strike. The entry region defines an angled portion that is angled at an entry angle relative to a flat ground surface. The midsole member is a supercritical foam.

66 Claims, 28 Drawing Sheets



Related U.S. Application Data

continuation of application No. 17/383,954, filed on Jul. 23, 2021.

(60) Provisional application No. 63/195,320, filed on Jun. 1, 2021, provisional application No. 63/055,506, filed on Jul. 23, 2020.

(51) **Int. Cl.**
A43B 13/04 (2006.01)
A43B 13/14 (2006.01)
A43B 13/37 (2006.01)

(52) **U.S. Cl.**
CPC ***A43B 13/37*** (2013.01); *A43B 13/026* (2013.01); *A43B 13/04* (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,096,605	B1 *	8/2006	Kozo	A43B 7/26 36/76 R
7,114,269	B2 *	10/2006	Meschan	A43B 5/00 36/35 R
8,296,973	B2	10/2012	Roberti	
8,307,569	B2	11/2012	McInnis	
8,387,285	B2	3/2013	Hartveld	
8,568,548	B2	10/2013	Park	
8,969,453	B2	3/2015	Park	
9,210,967	B2	12/2015	Gerber	
9,591,891	B1 *	3/2017	Baucom	A43B 13/122
9,605,191	B2	3/2017	Park	
9,936,765	B2 *	4/2018	Sato	A43B 13/186
9,961,959	B2	5/2018	Gerber	
10,441,027	B2 *	10/2019	Bartel	A43B 7/148
10,952,498	B2	3/2021	Bruce	
2002/0017036	A1	2/2002	Berger	
2005/0026775	A1	2/2005	Grigsby	
2005/0267775	A1 *	12/2005	Willis	A43B 3/24 705/1.1
2006/0277796	A1 *	12/2006	Gallegos	A43B 17/02 36/44
2008/0244932	A1 *	10/2008	Nau	A43B 3/0036 36/102
2009/0019730	A1 *	1/2009	Salminen	A43B 7/1425 36/102
2009/0119951	A1	5/2009	Hartveld	
2010/0307032	A1 *	12/2010	Geer	A43D 3/02 36/47
2012/0079740	A1 *	4/2012	Zhou	A43B 13/141 36/43
2013/0205619	A1	8/2013	Hartveld	
2016/0081427	A1 *	3/2016	Iuchi	A43B 13/141 36/28
2016/0213090	A1 *	7/2016	Nakano	A43B 23/0245
2016/0353836	A1	12/2016	Luedecke	
2016/0353838	A1	12/2016	Takeshita	
2017/0095033	A1 *	4/2017	Farina	A43B 7/18
2018/0132564	A1 *	5/2018	Bruce	A43B 13/189
2018/0153254	A1	6/2018	Fusco	
2018/0263335	A1 *	9/2018	Iuchi	A43B 13/122
2019/0016079	A1 *	1/2019	Tanabe	A43B 5/00
2019/0150554	A1 *	5/2019	Strickland	A43B 7/143
2019/0150562	A1 *	5/2019	Bartel	A43B 13/22
2019/0200700	A1	7/2019	Hale	
2019/0373982	A1	12/2019	Dupre	
2019/0387837	A1	12/2019	Luh	
2020/0121021	A1	4/2020	Bartel	
2020/0170337	A1 *	6/2020	Lucca	A43B 13/122
2020/0383421	A1 *	12/2020	Bidal	A43B 13/026
2020/0383422	A1 *	12/2020	Bidal	A43B 13/41
2021/0137213	A1 *	5/2021	Stockbridge	A43B 7/1445
2021/0267306	A1 *	9/2021	Sakaguchi	A43B 13/188
2022/0053886	A1 *	2/2022	Bramani	A43B 13/14
2023/0165336	A1 *	6/2023	Girard	A43B 13/186 36/25 R
2023/0210214	A1 *	7/2023	Wills, III	A43B 5/06 36/102

FOREIGN PATENT DOCUMENTS

CN	109222324	A	1/2019
CN	19952042	A	6/2019
CN	209391167	U	9/2019
CN	212165086	U	12/2020
CN	212787628	U	3/2021
DE	112006002347	T5	7/2008
DE	102016118168	A1	11/2017
DE	112006002347	B4	7/2019
EP	3574787	A1	12/2019
GB	2288550	B	2/1998
GB	2425455	A	11/2006
GB	2431334	A	4/2007
GB	2431333	B	10/2010
GB	2437698	B	10/2010
GB	2499416	A	8/2013
JP	2509505	B2	6/1996
JP	6307728	B1	4/2018
JP	2021030079	A	3/2021
WO	2007026175	A1	3/2007
WO	2016132927	A1	8/2016
WO	2018137649	A1	8/2018
WO	2019204358	A1	10/2019

OTHER PUBLICATIONS

First Office Action in Chinese Application No. 2021108392082 dated Jan. 19, 2023 (12 pages).

* cited by examiner

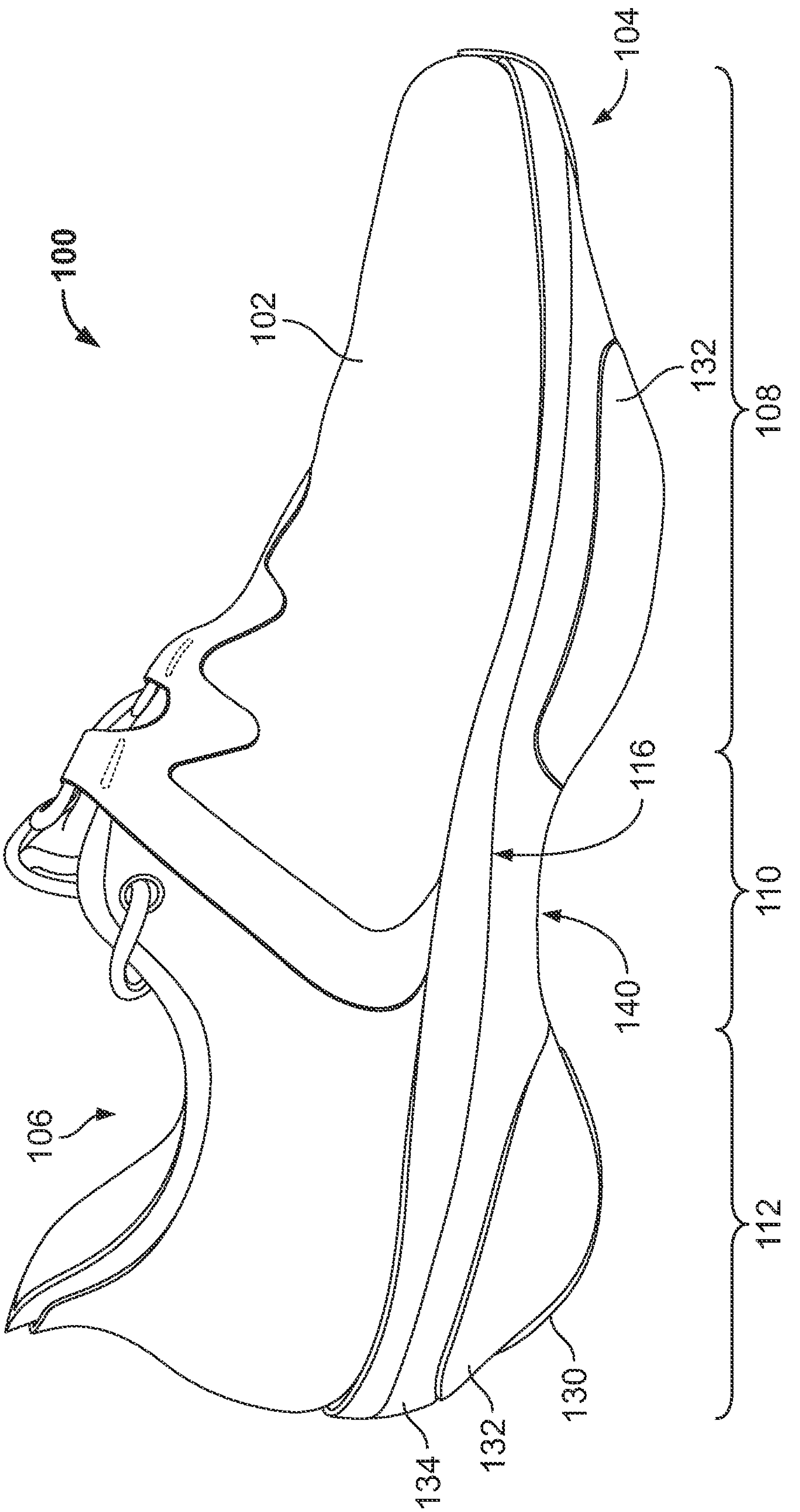


FIG. 1

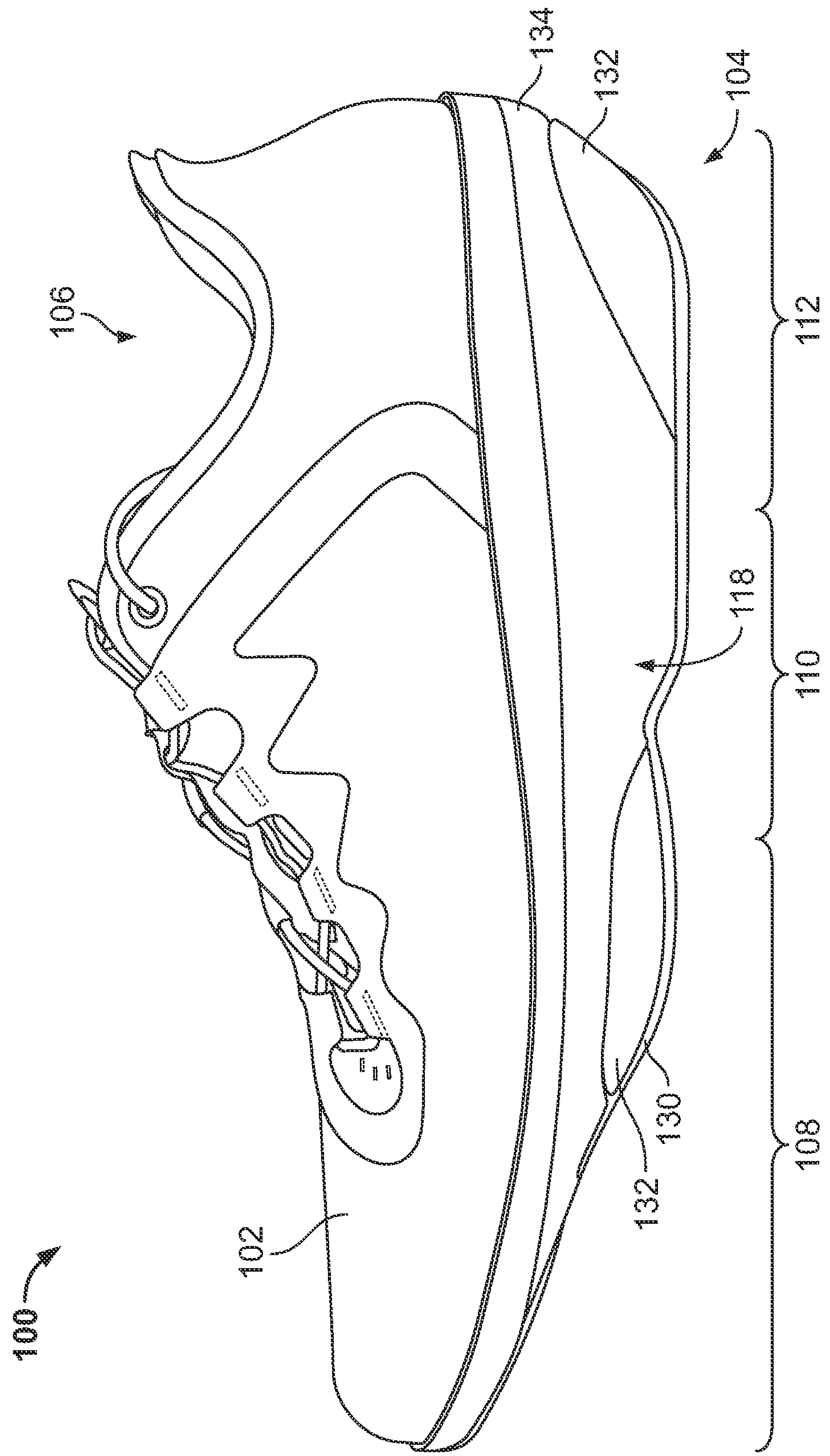


FIG. 2

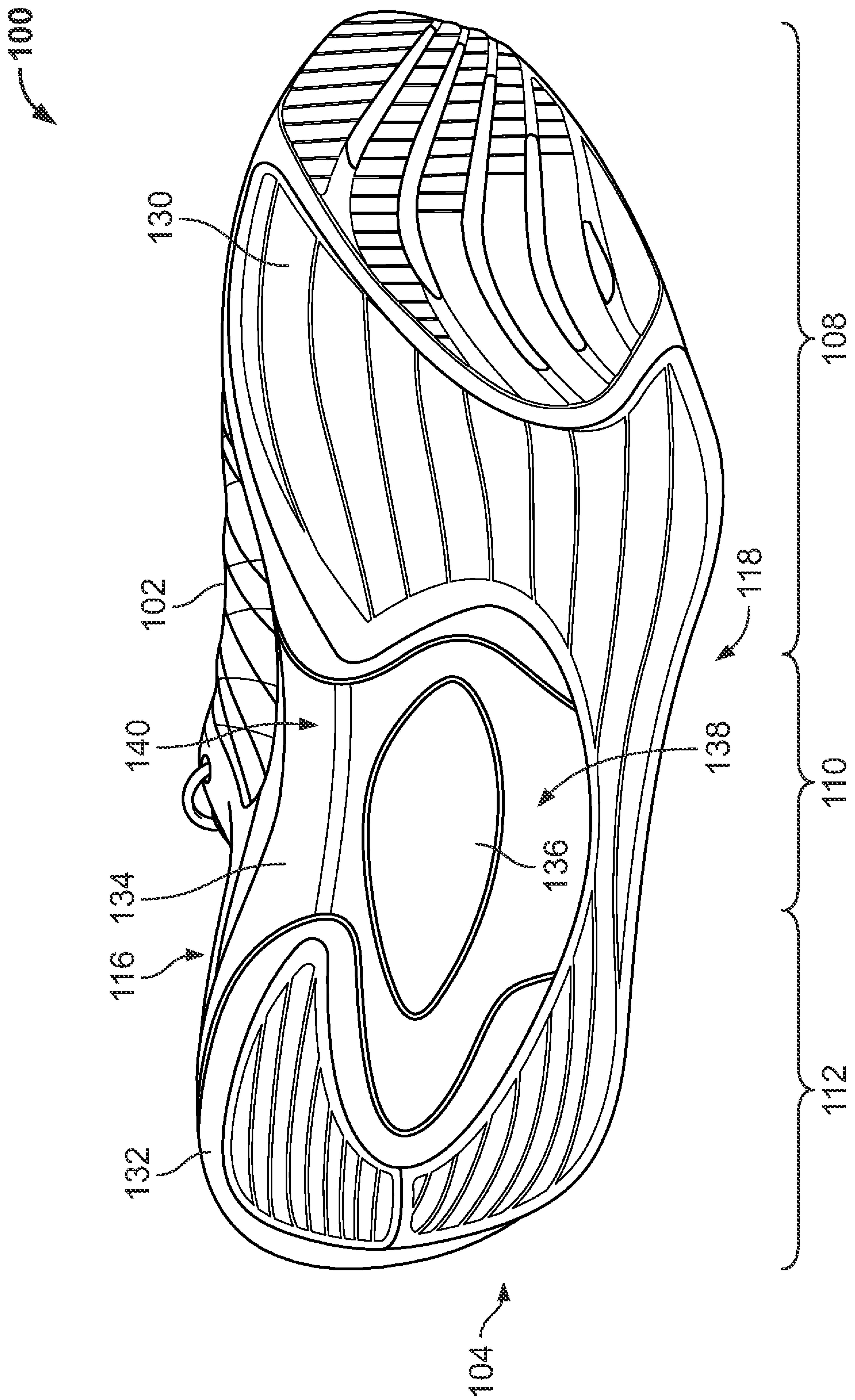
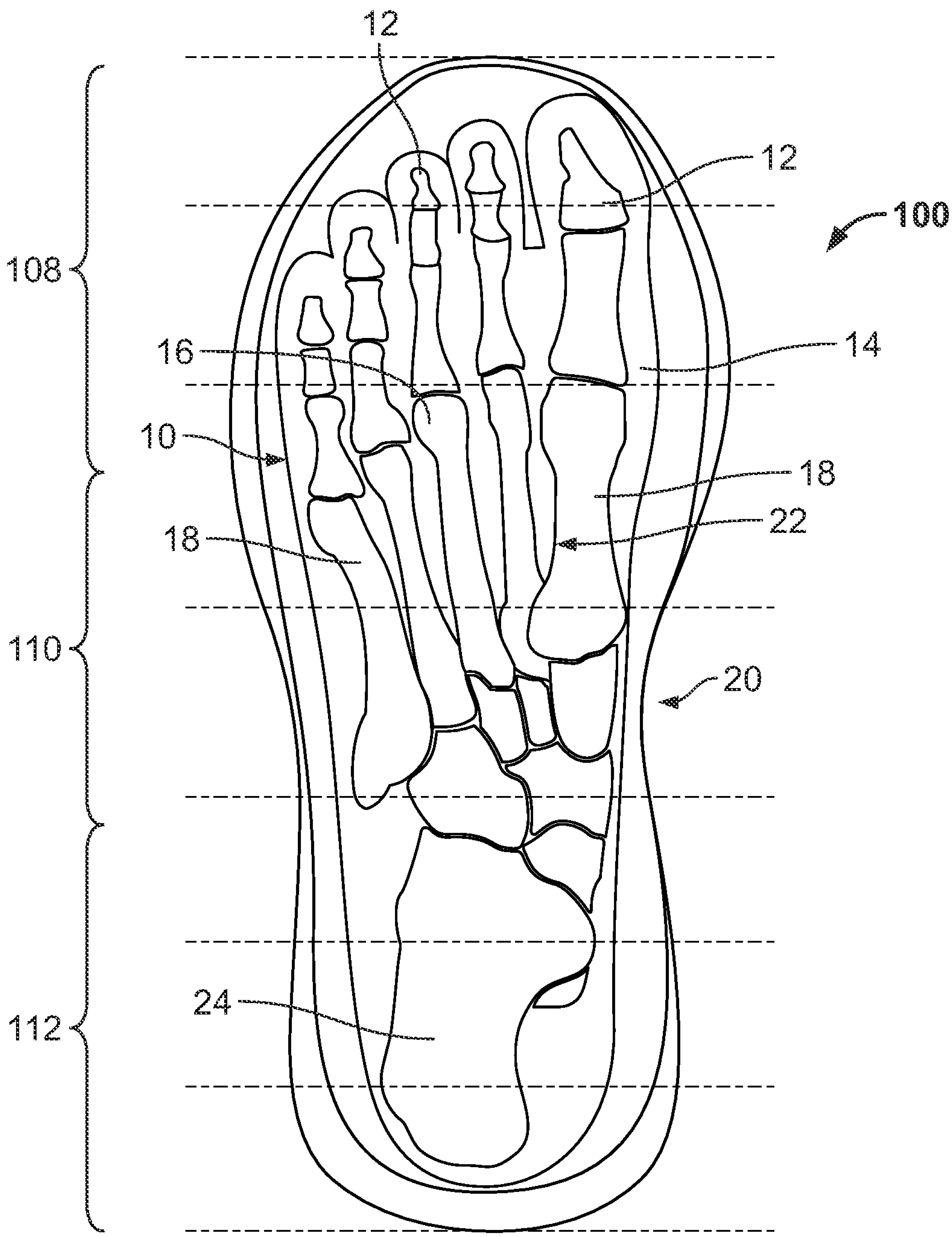


FIG. 3



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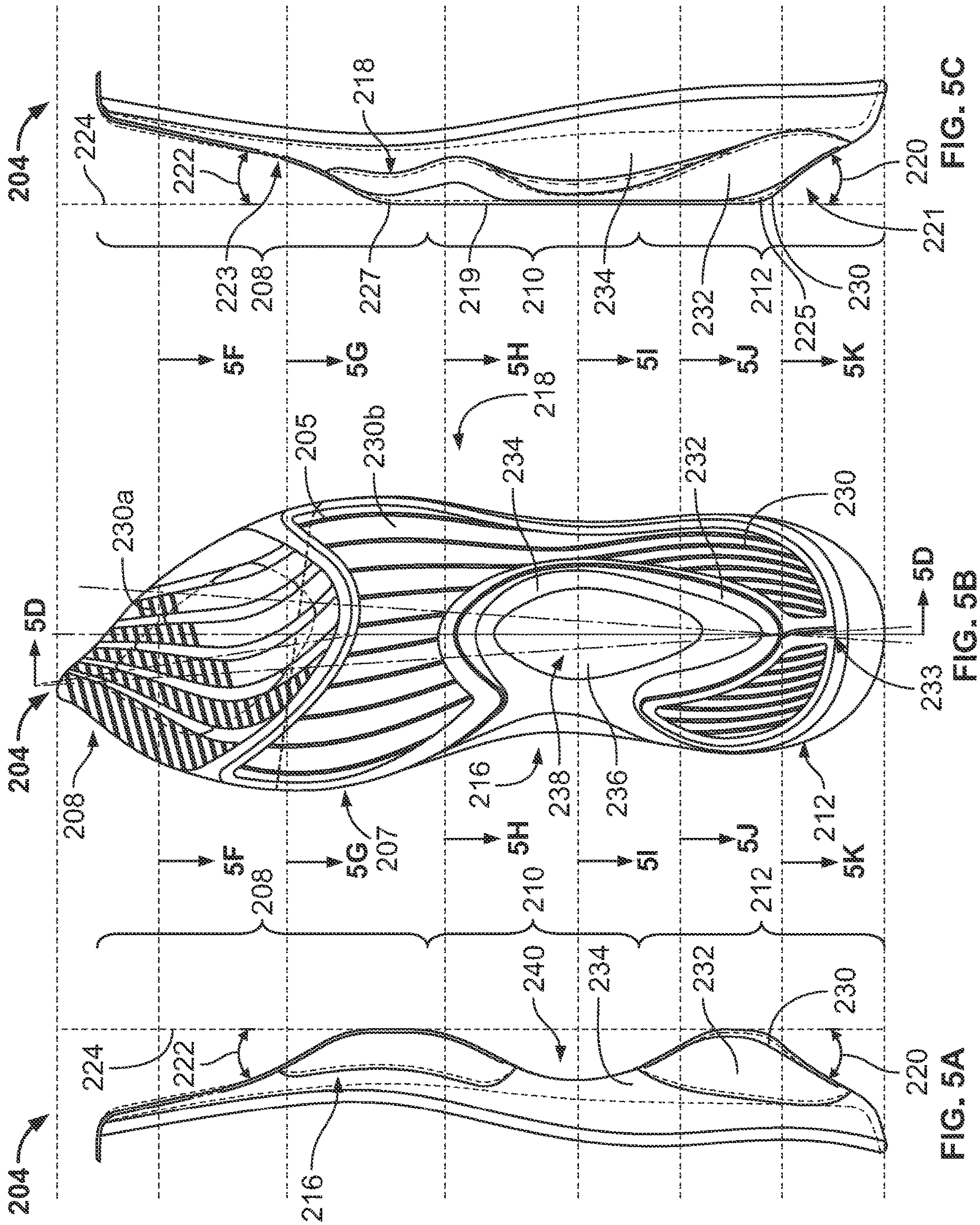

FIG. 5A

FIG. 5B

FIG. 5C

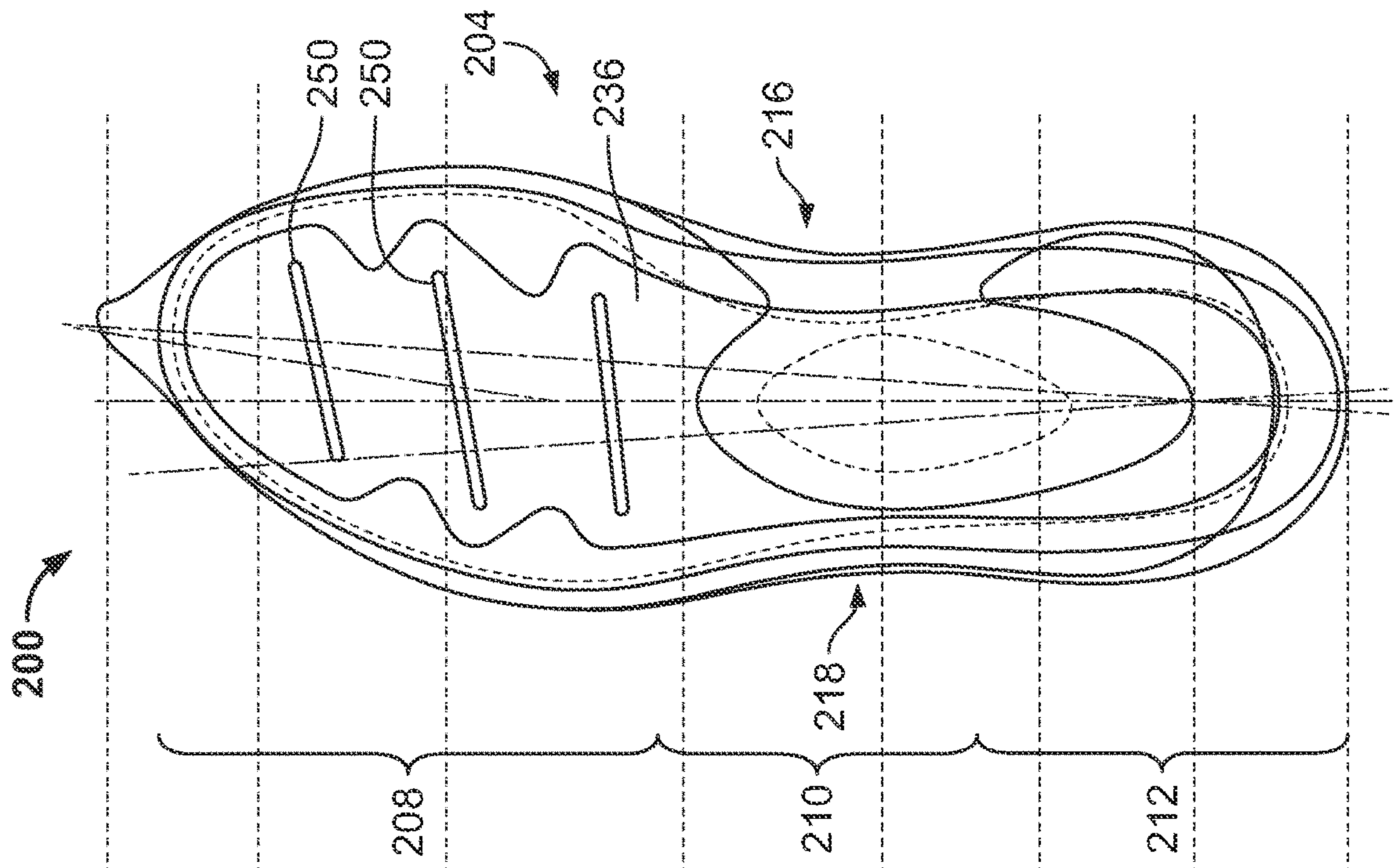
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FIG. 5E

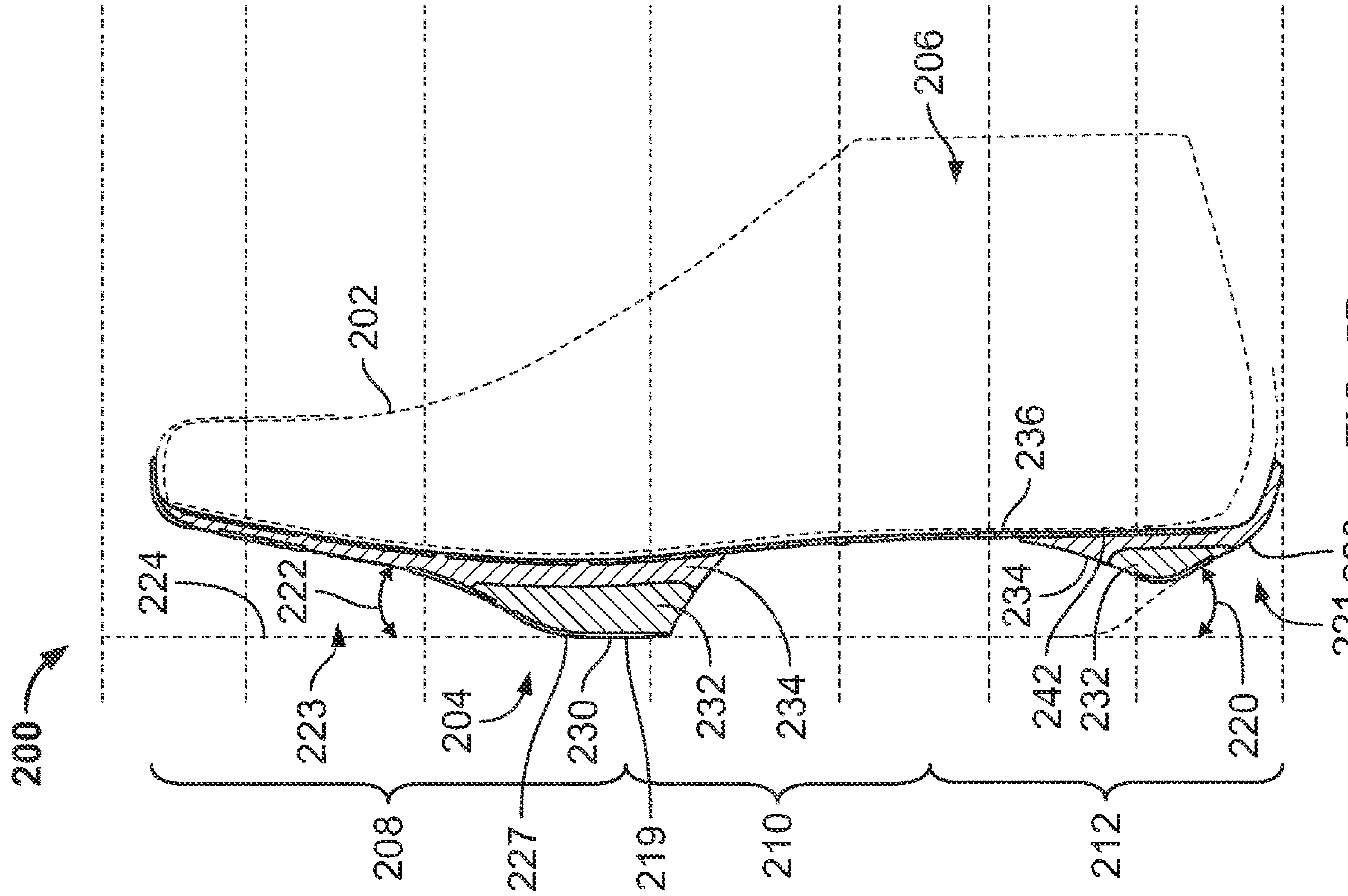
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FIG. 5D

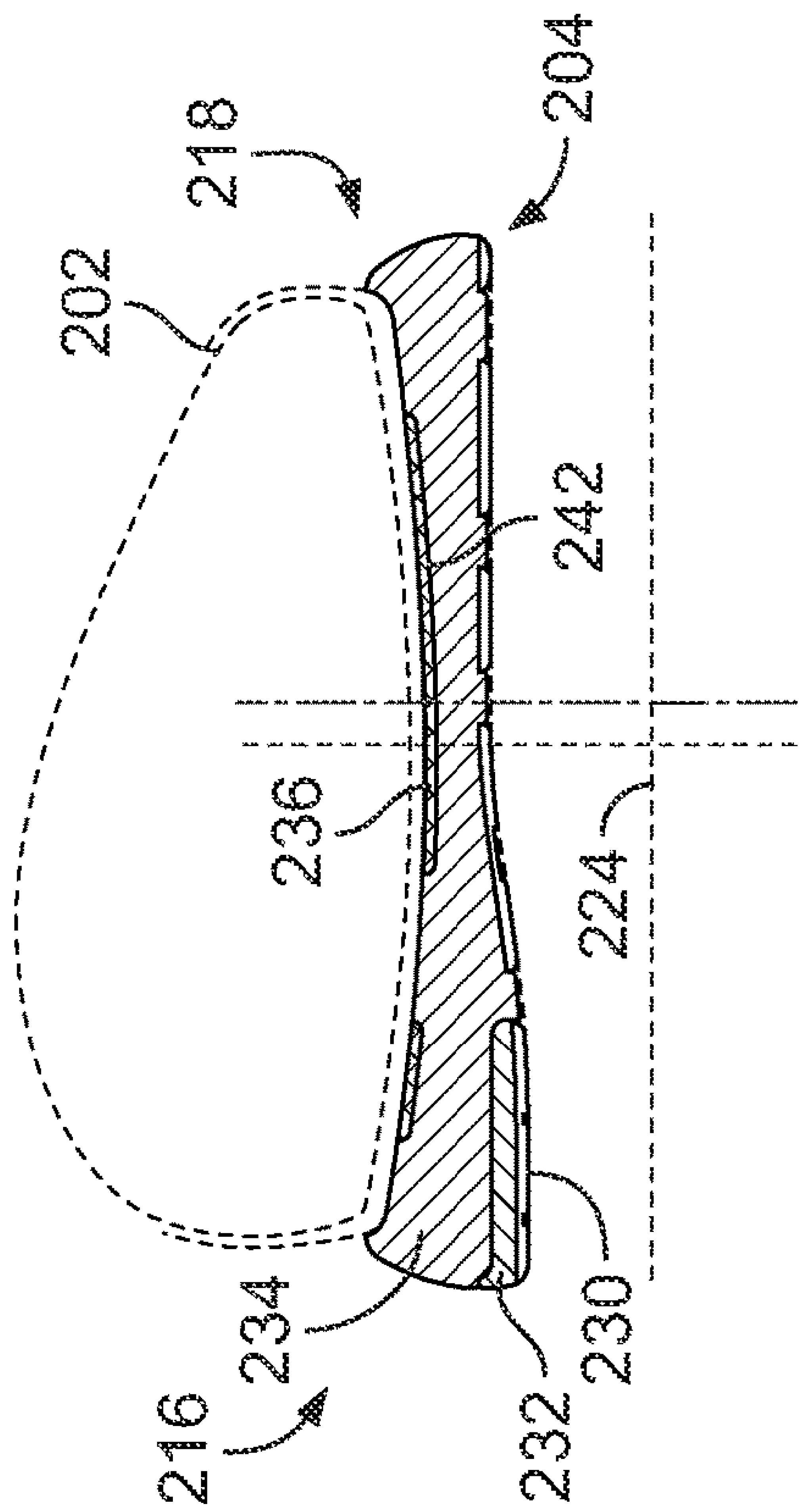


FIG. 5G

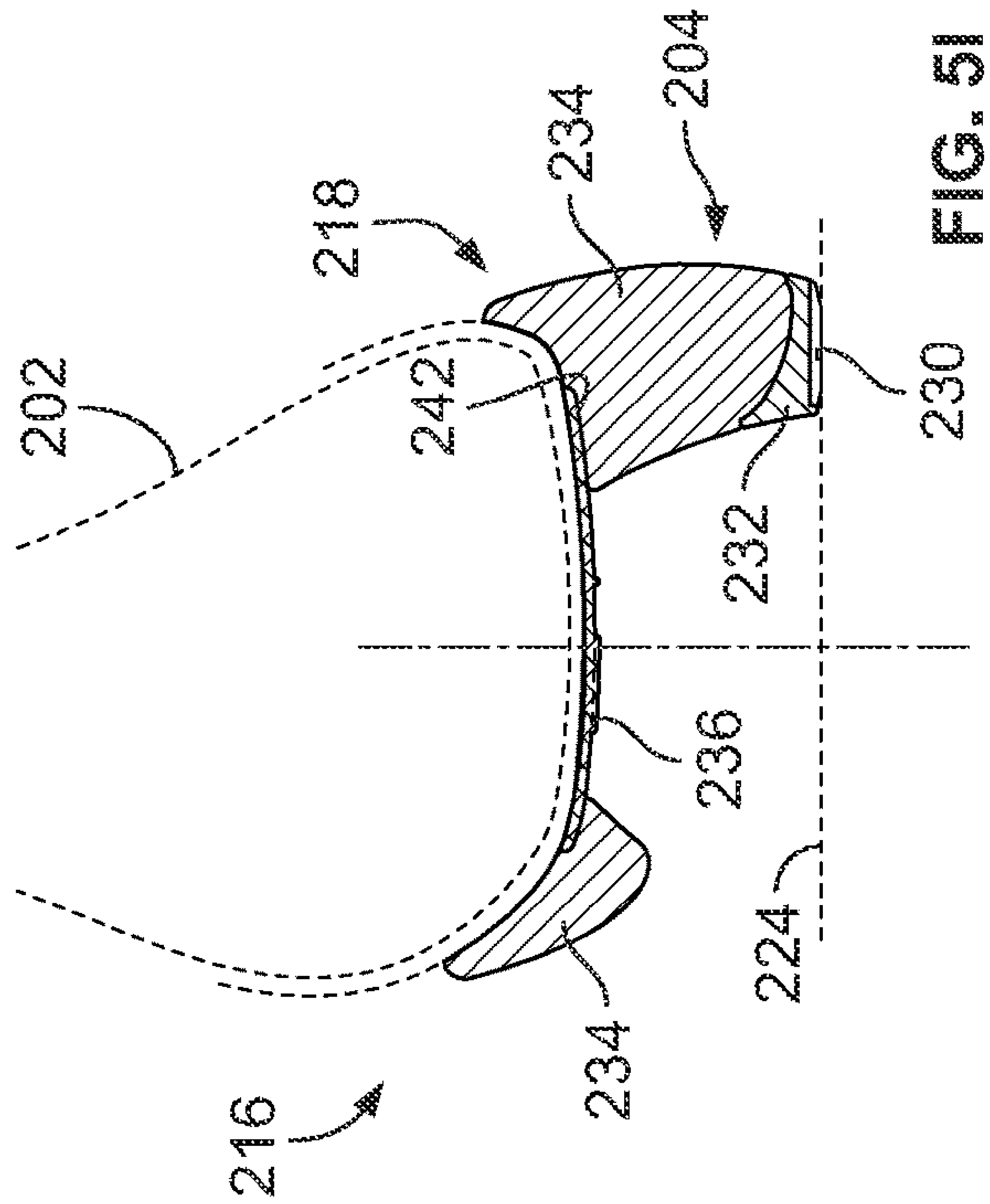
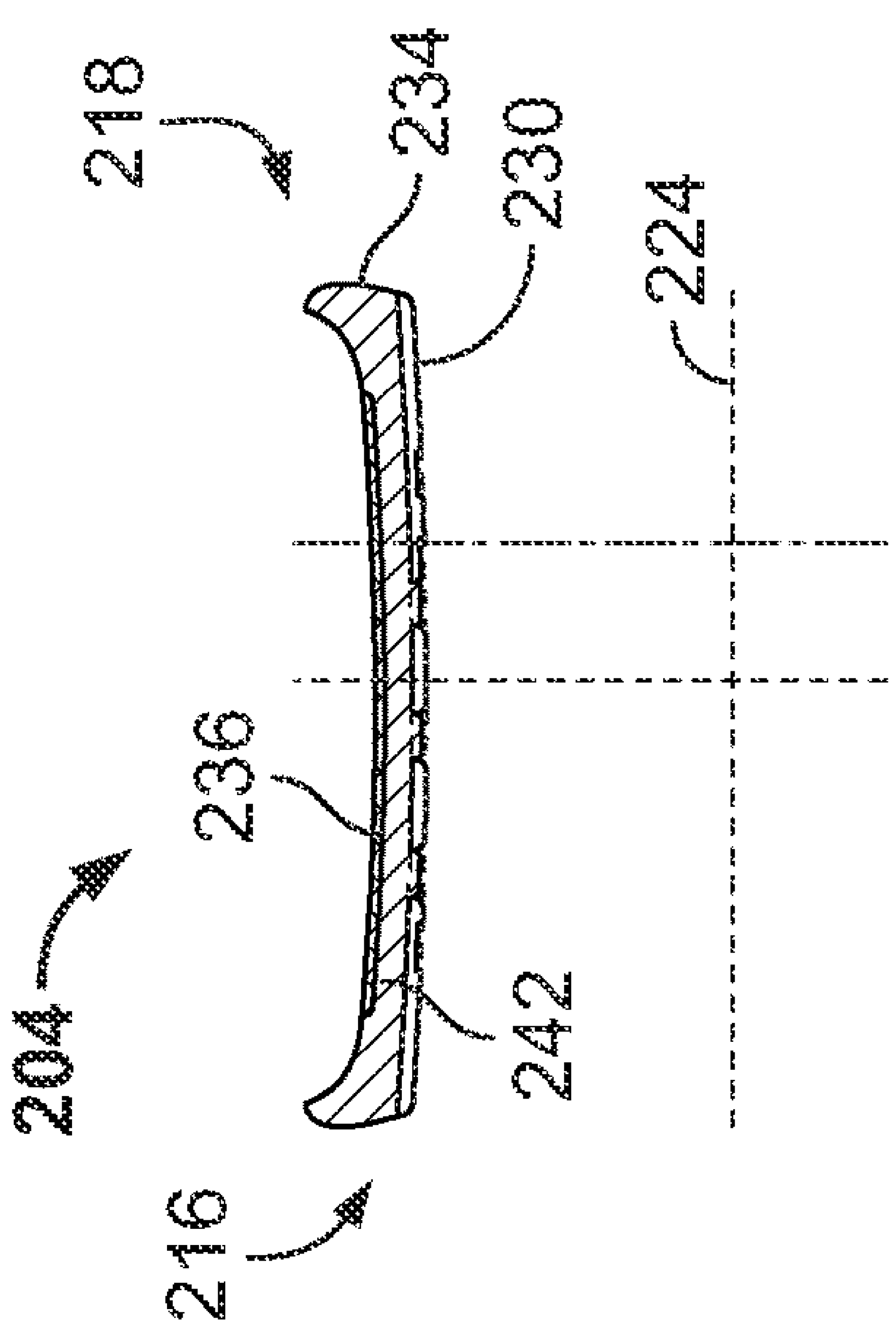


FIG. 5I



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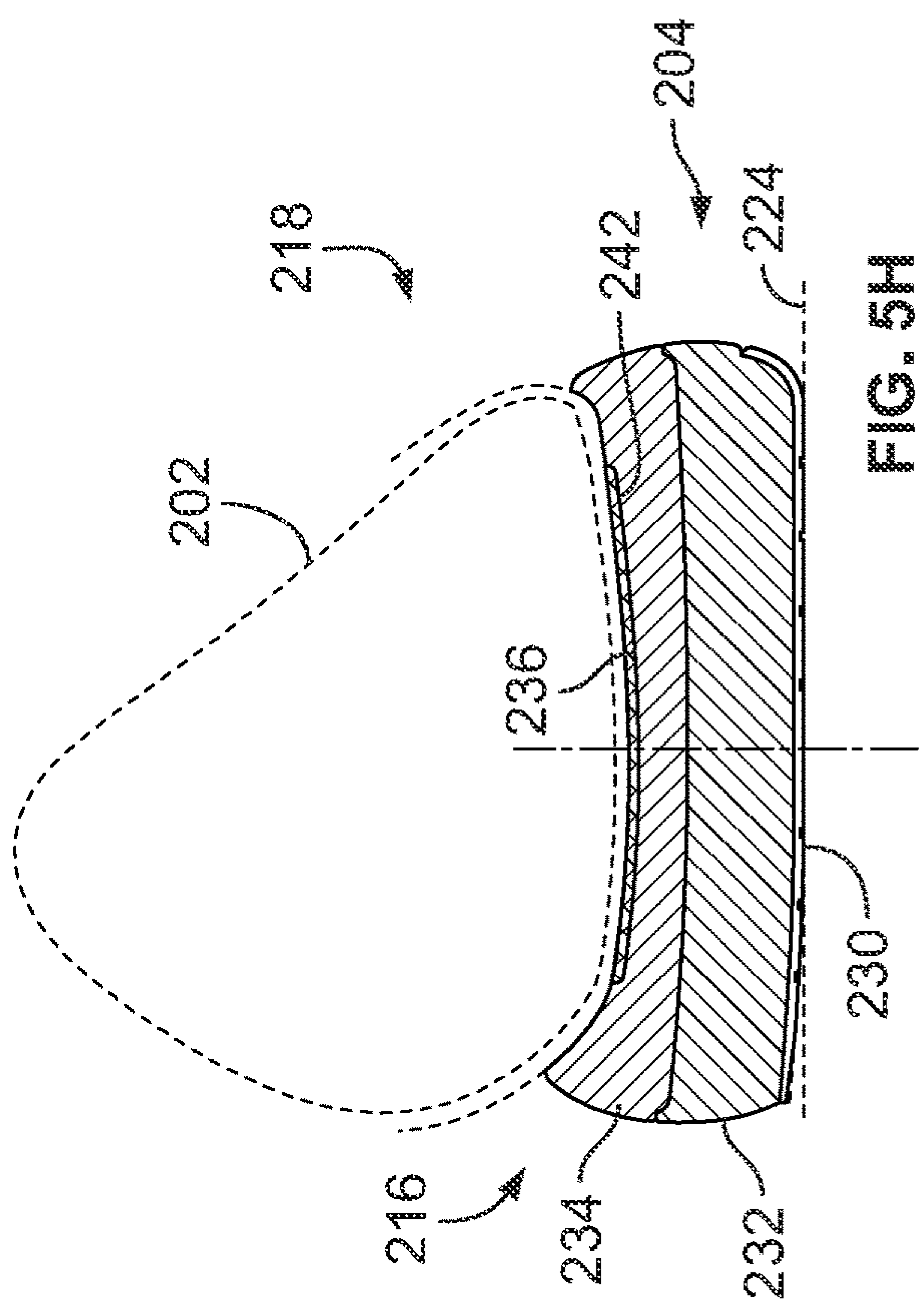

FIG. 5H

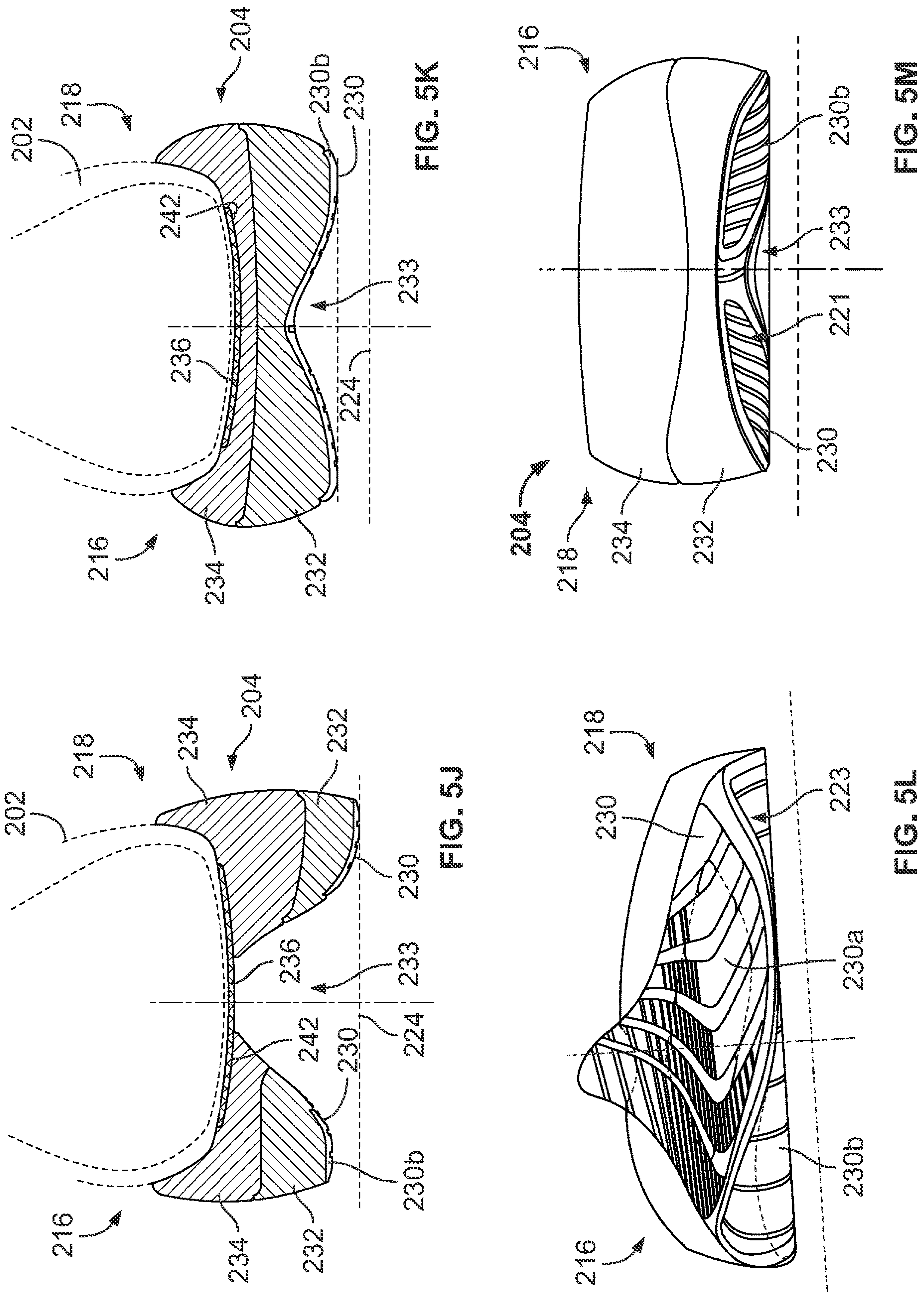

FIG. 5K

FIG. 5M

FIG. 5J

FIG. 5L

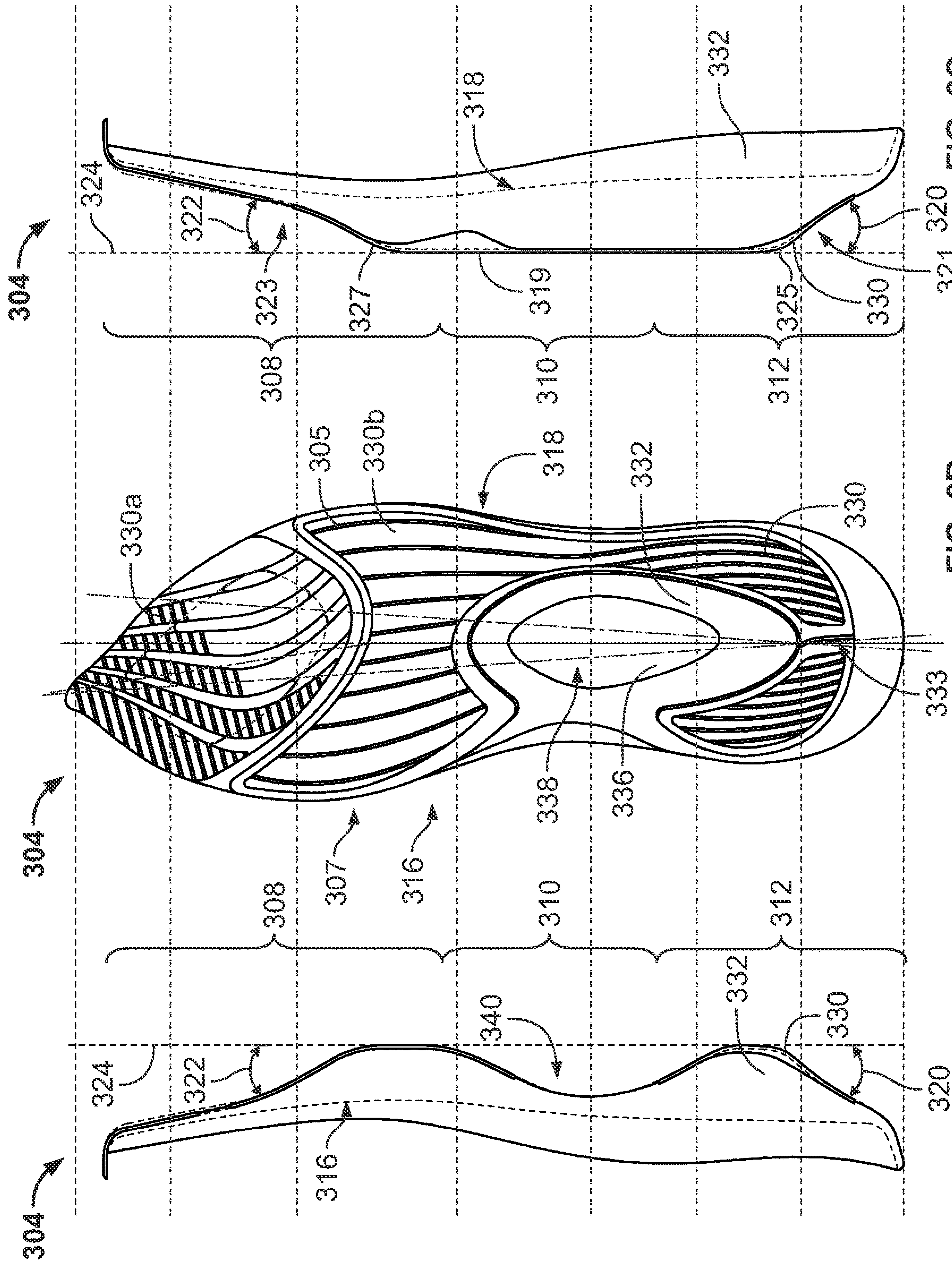

FIG. 6A

FIG. 6B

FIG. 6C

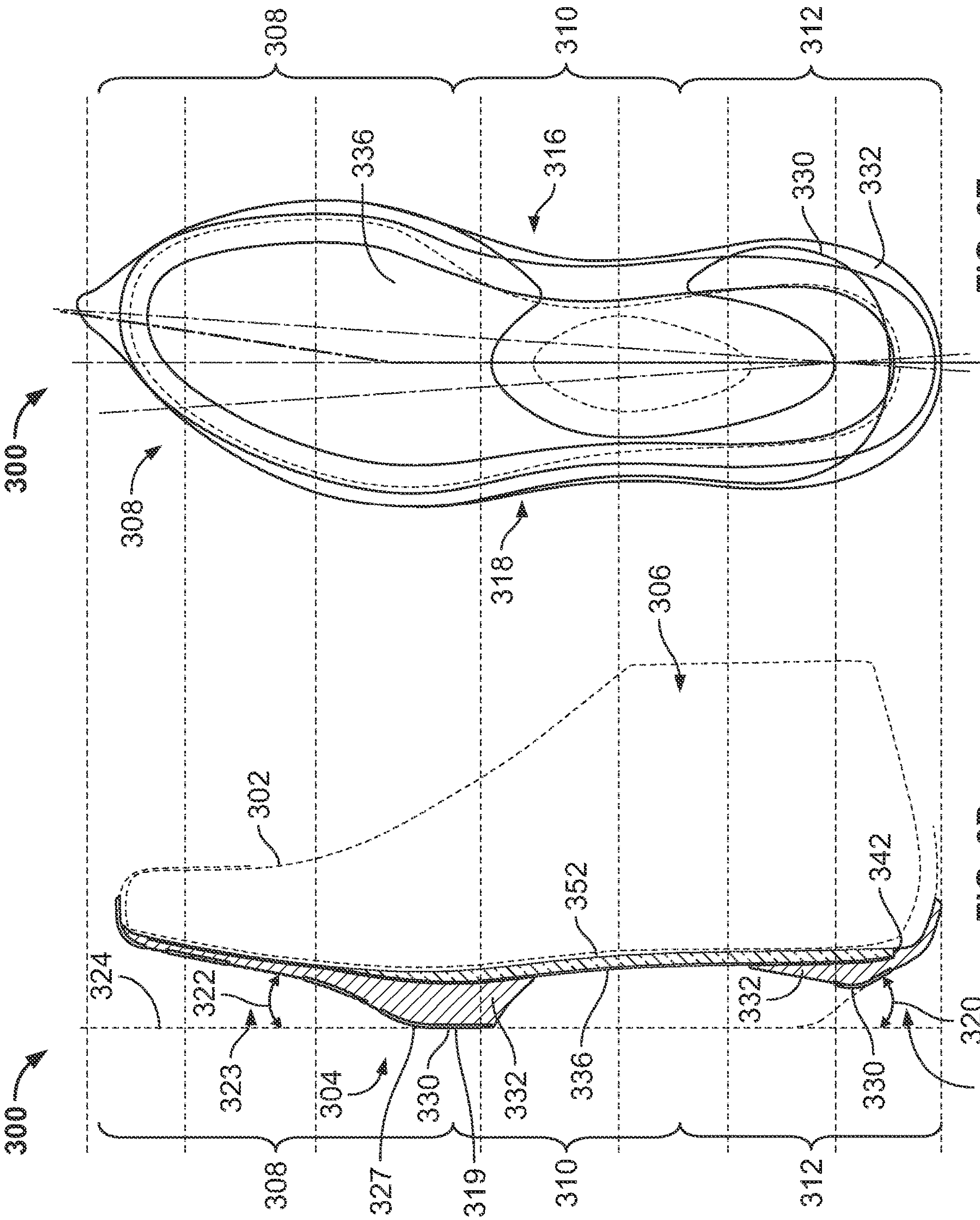
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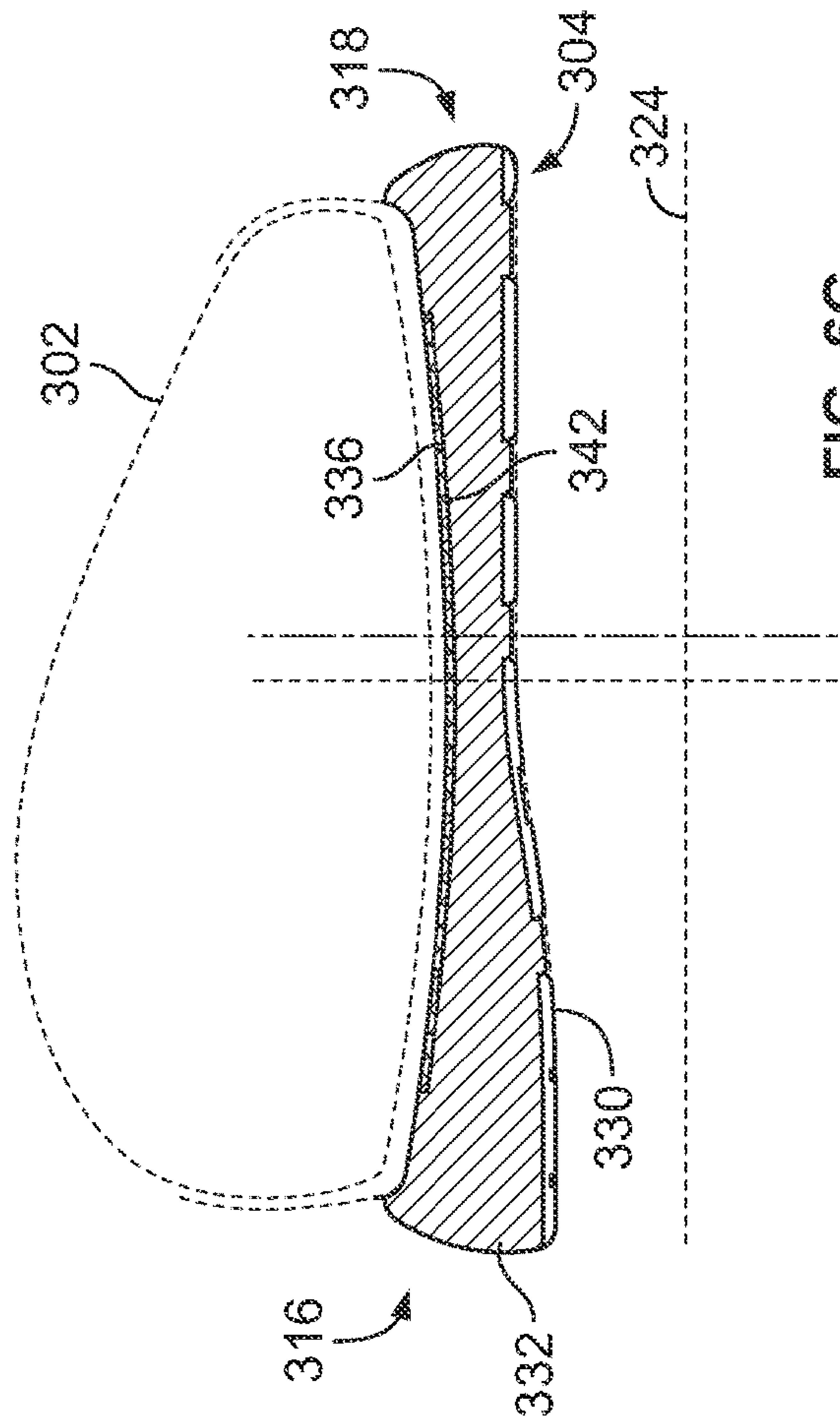
FIG. 6E

FIG. 6D



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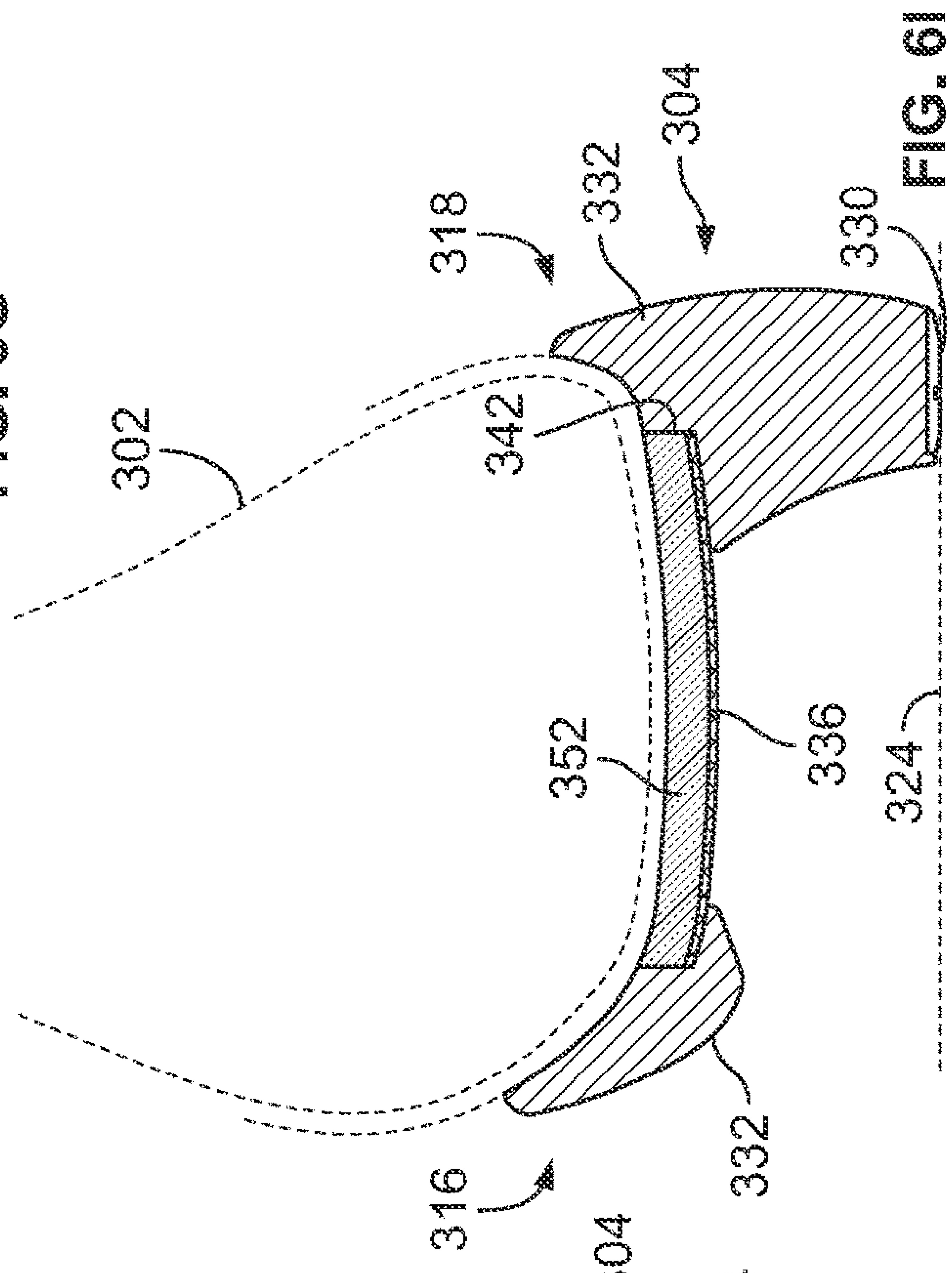

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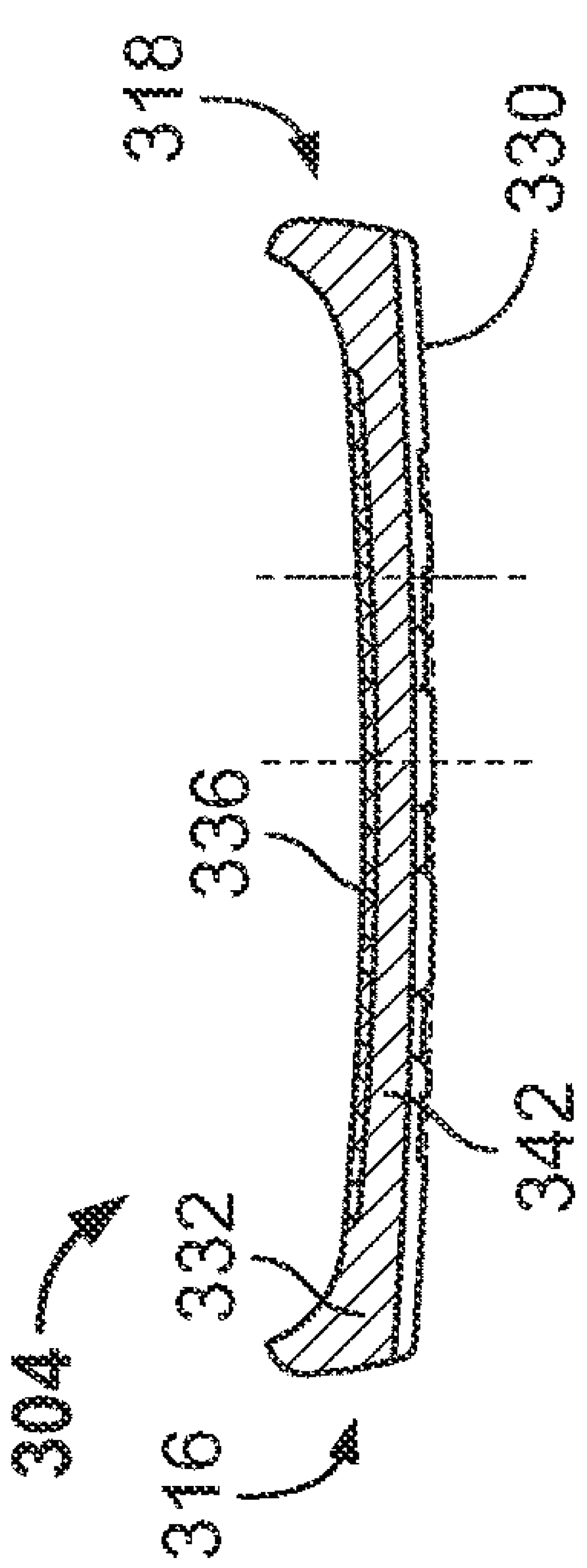

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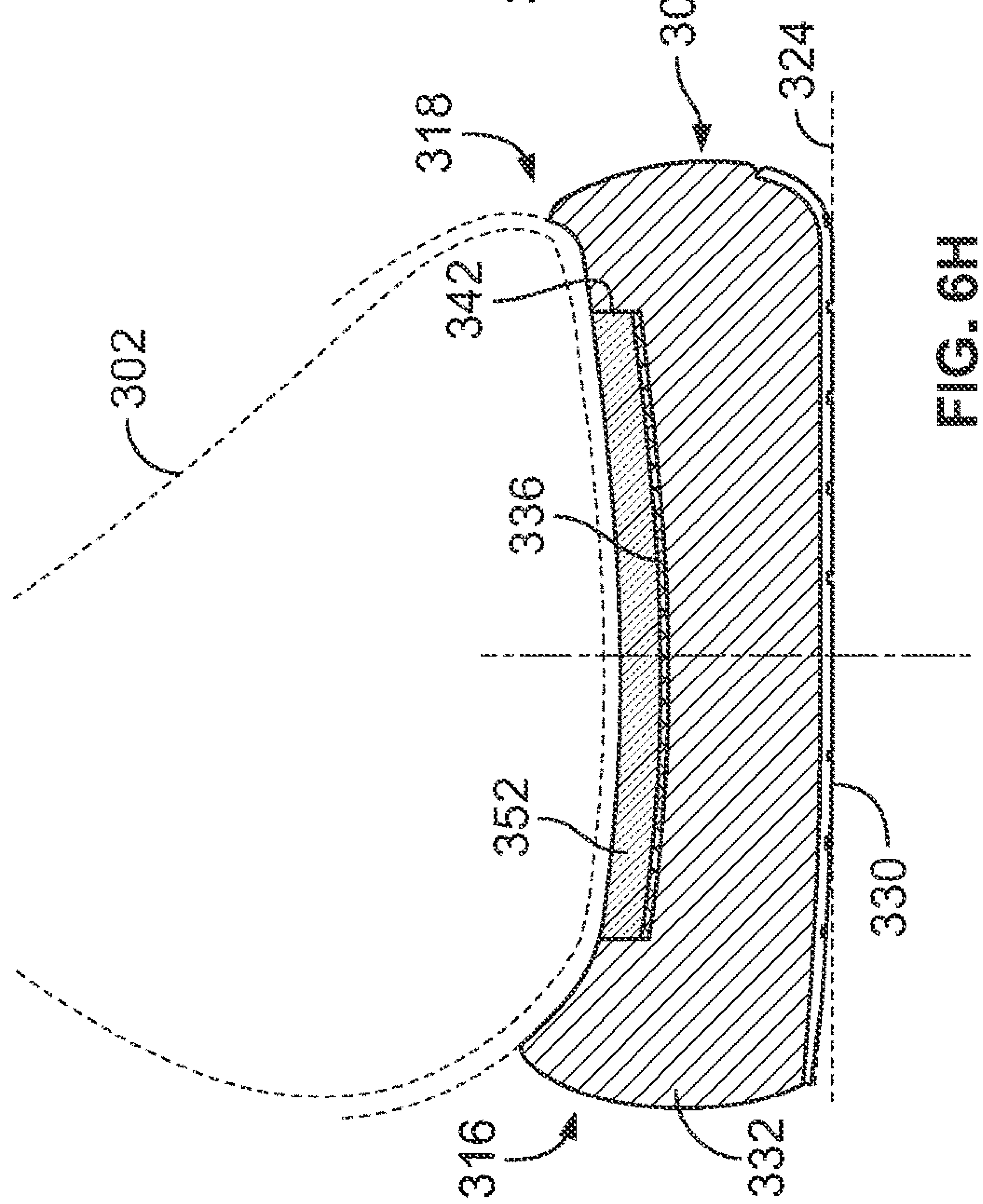

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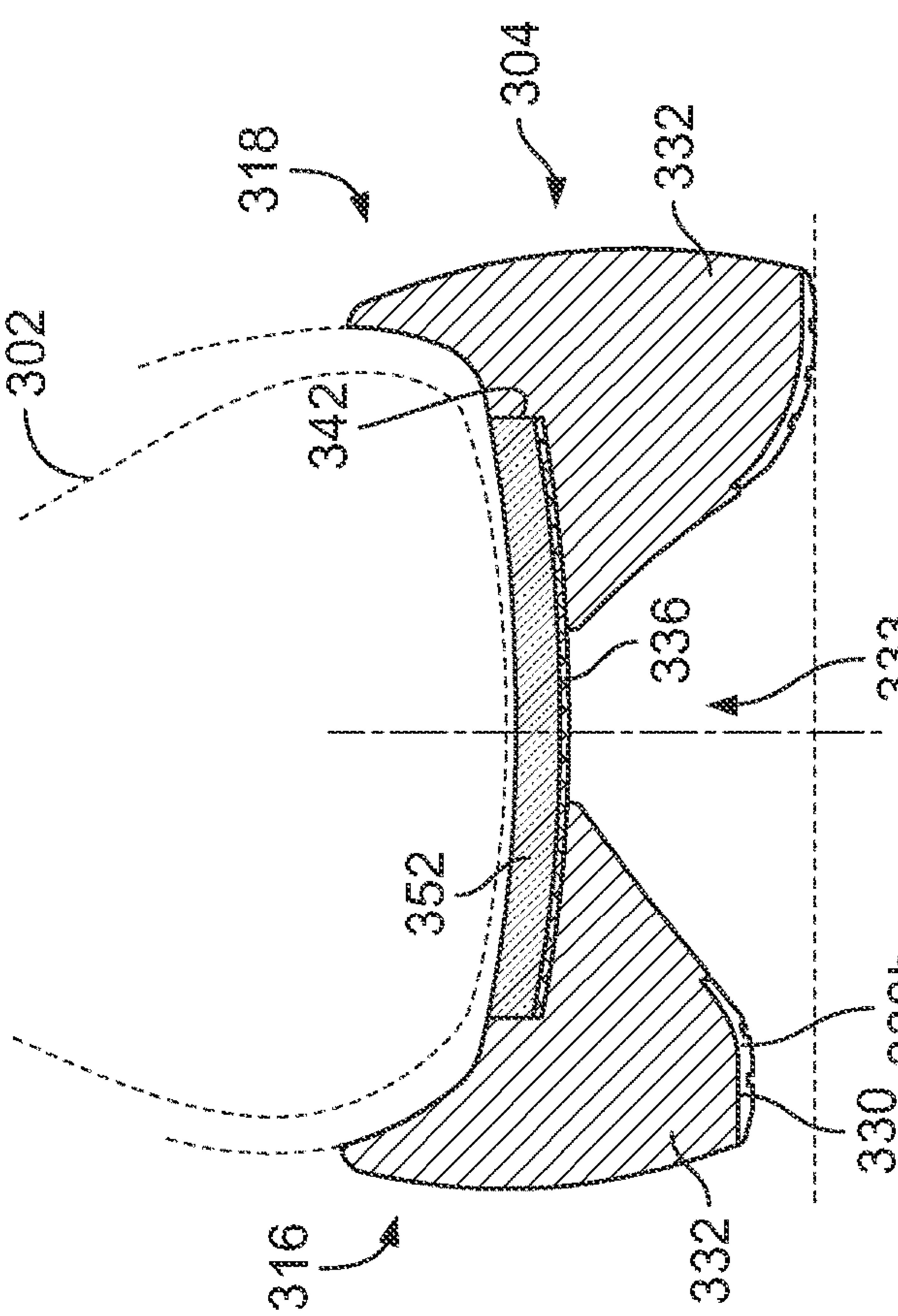

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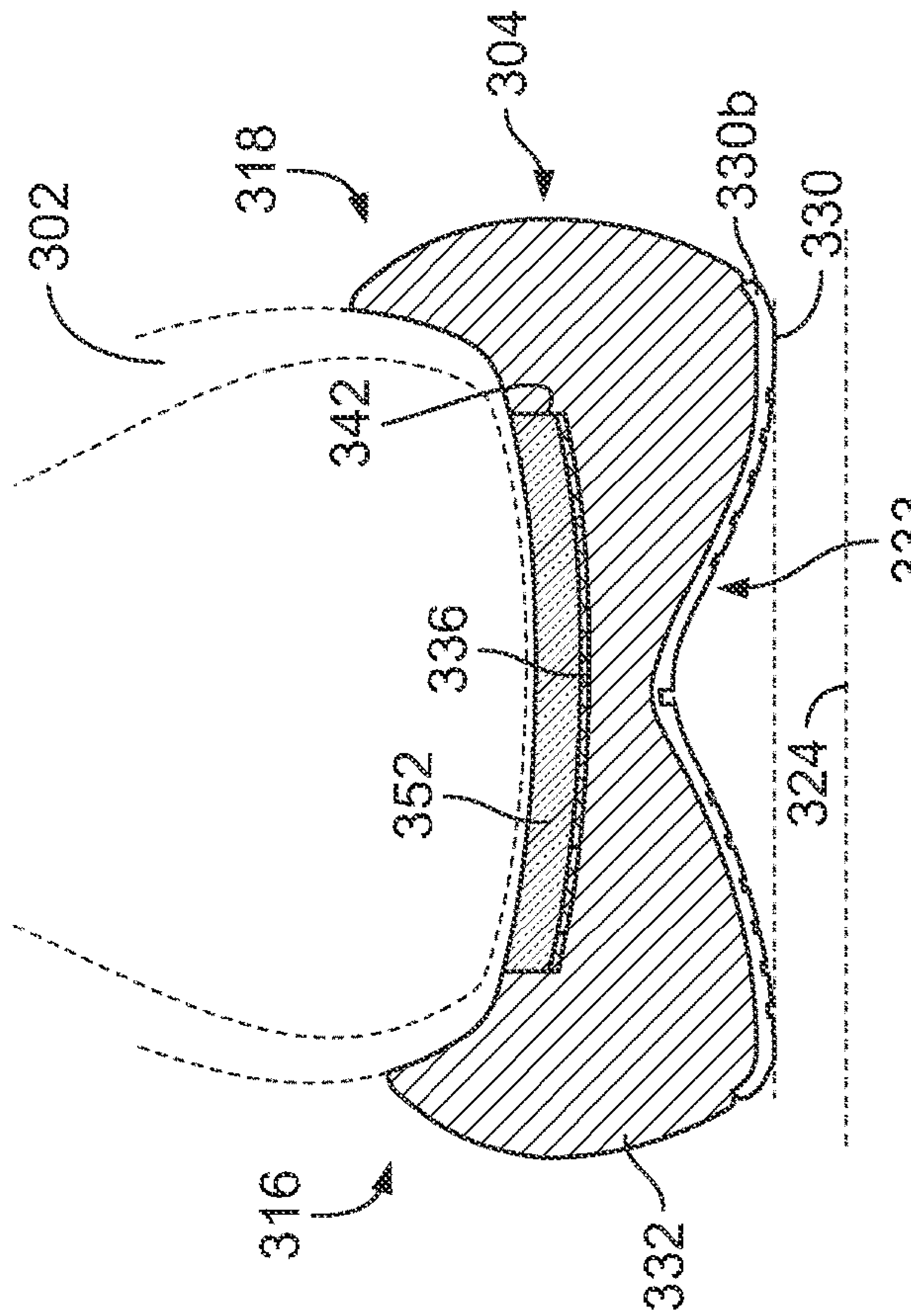

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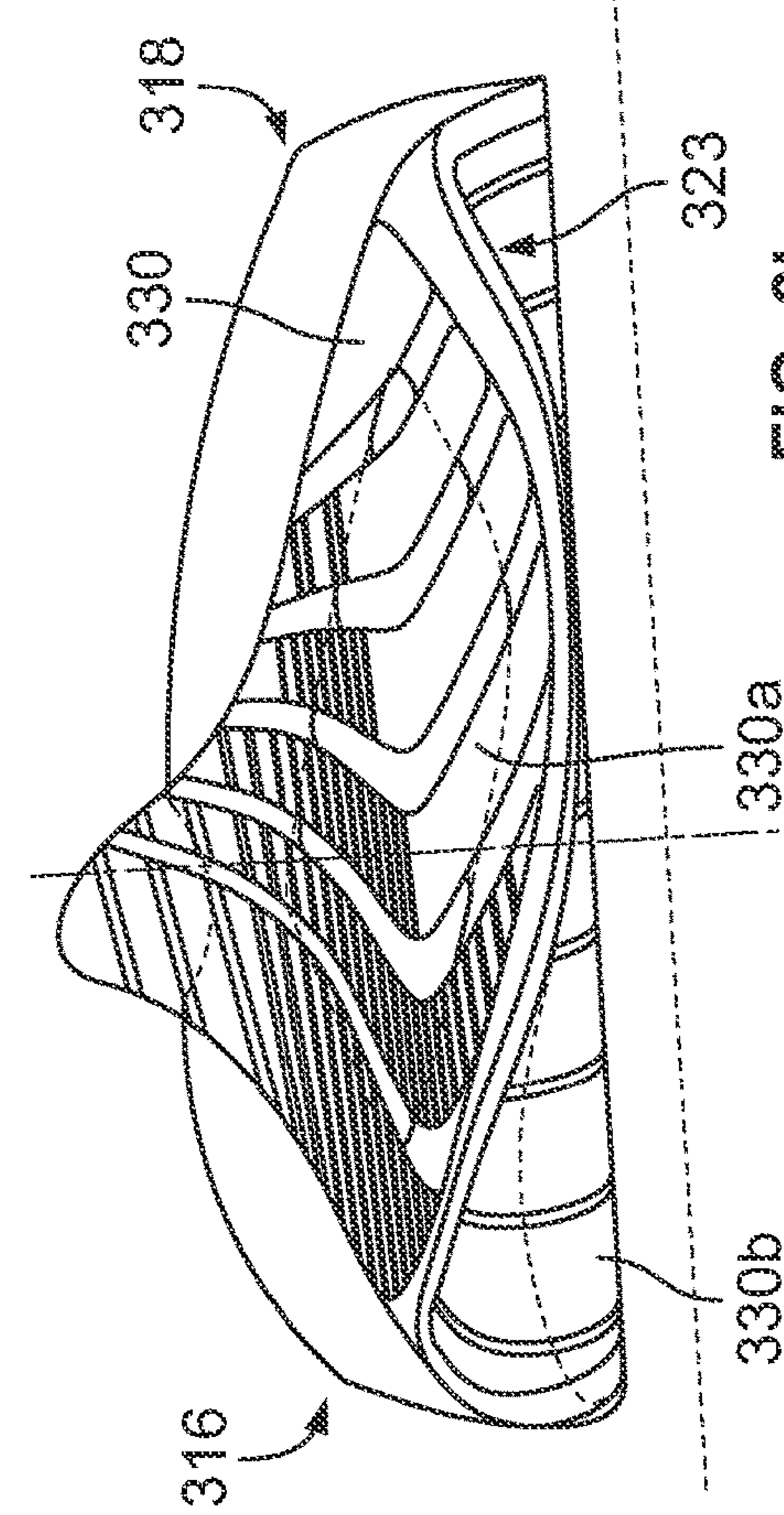

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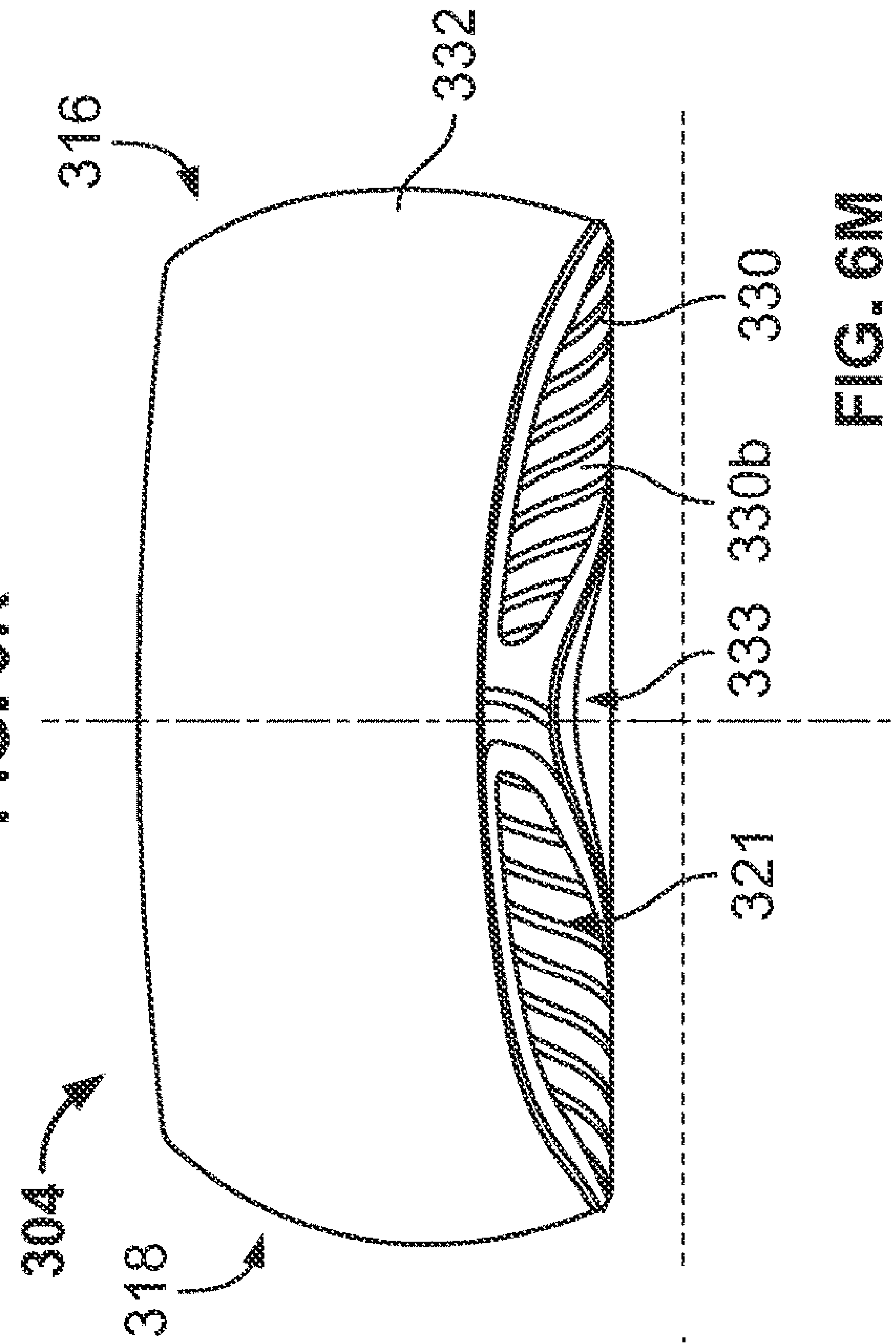

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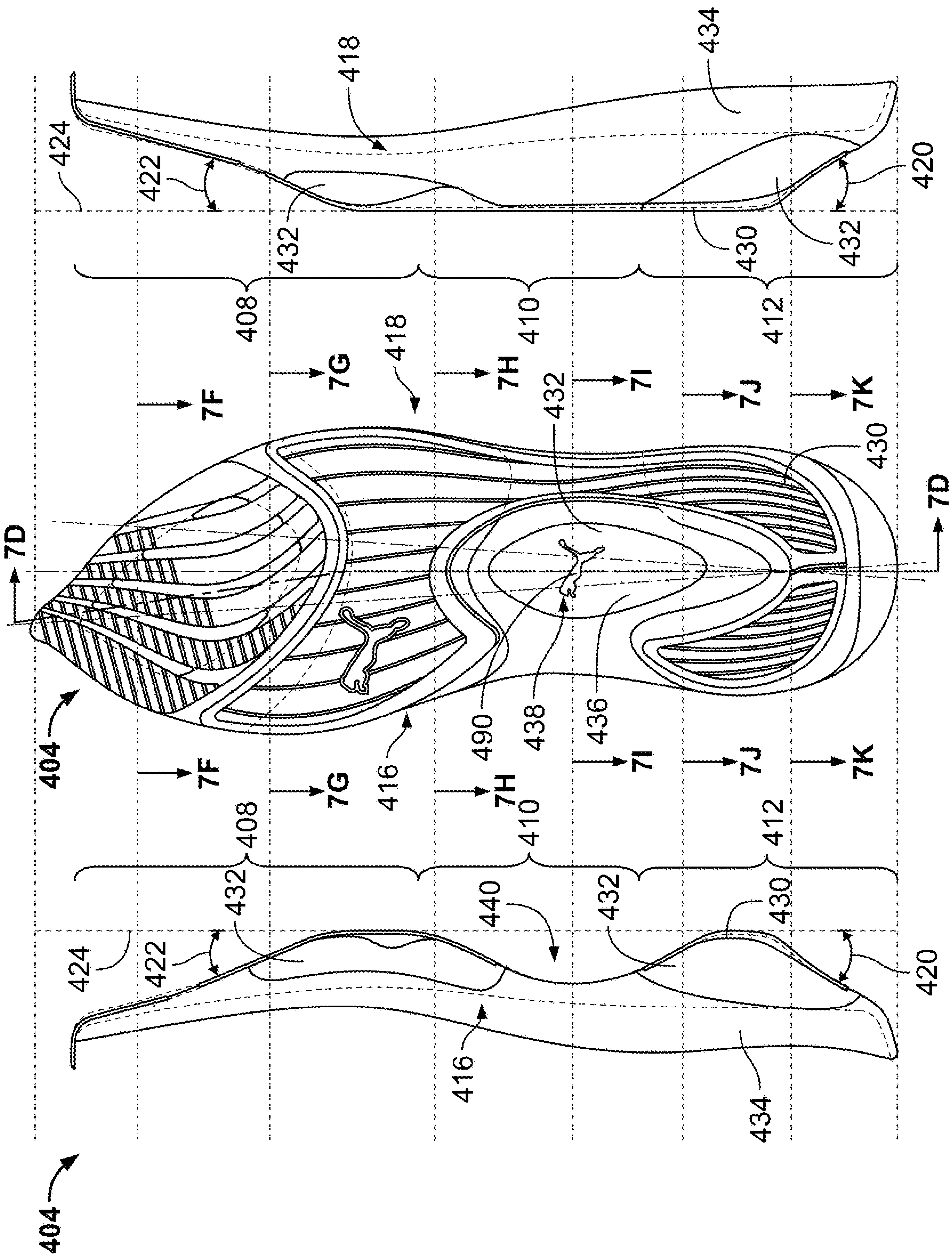

FIG. 7A

FIG. 7B

FIG. 7C

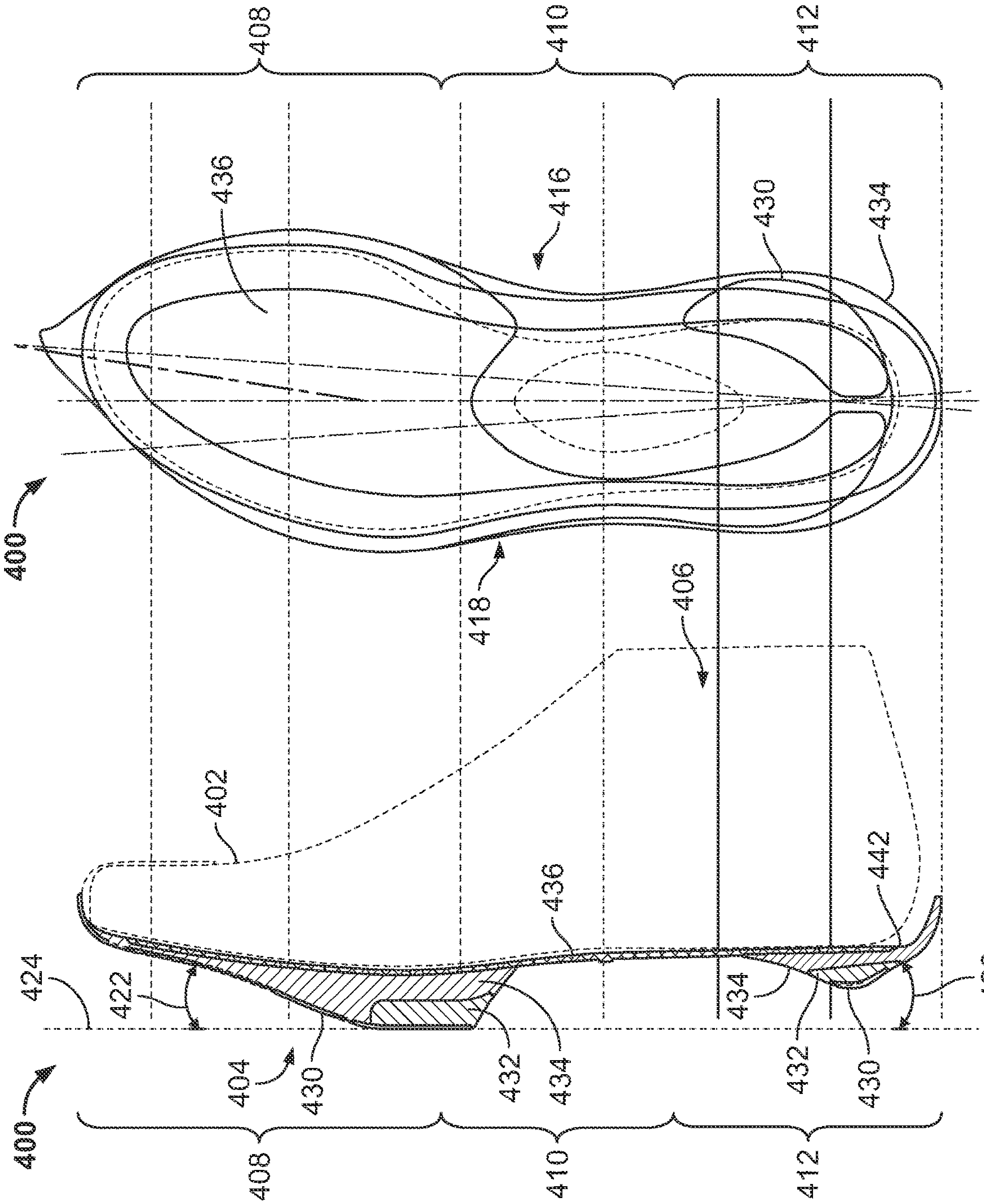
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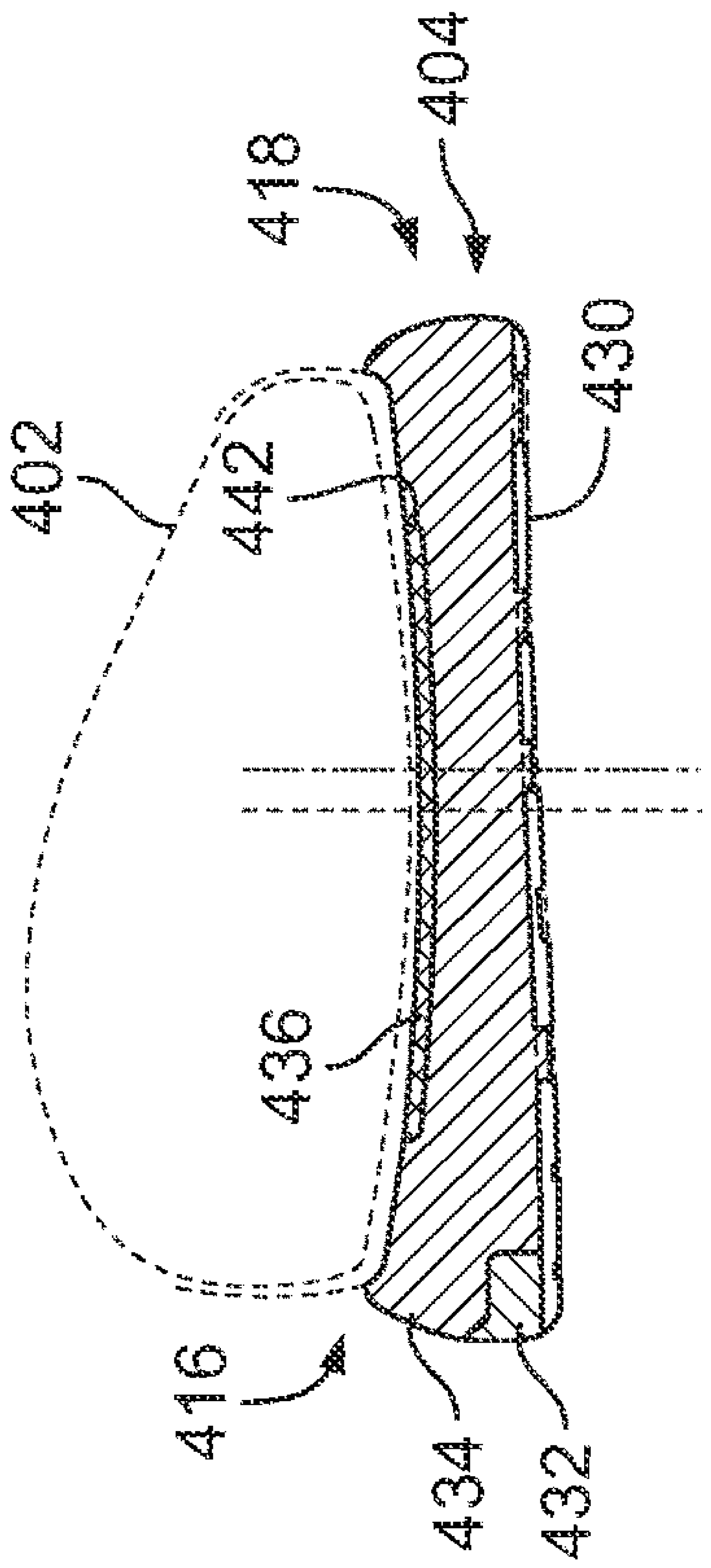
FIG. 7E

FIG. 7D



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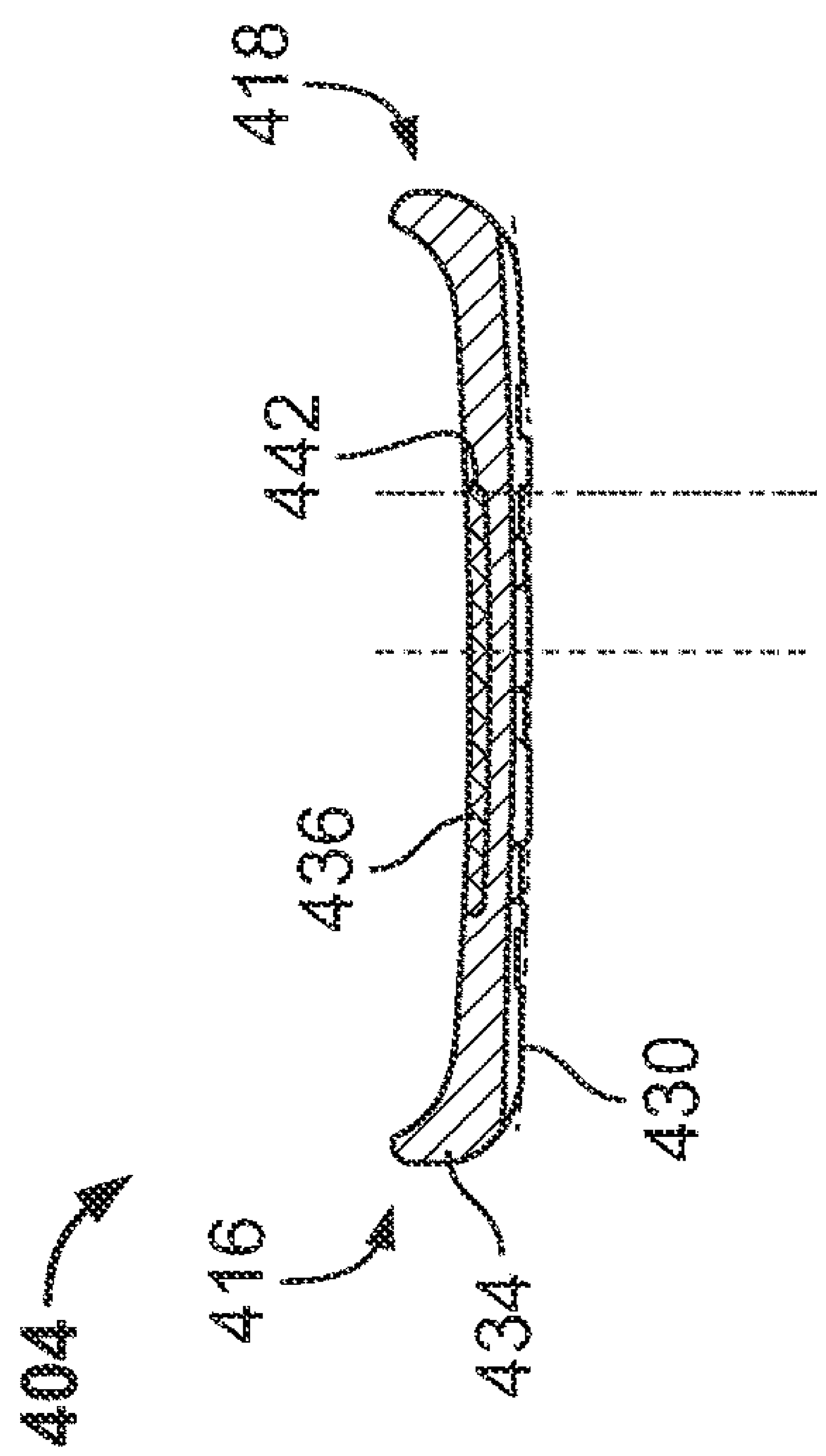

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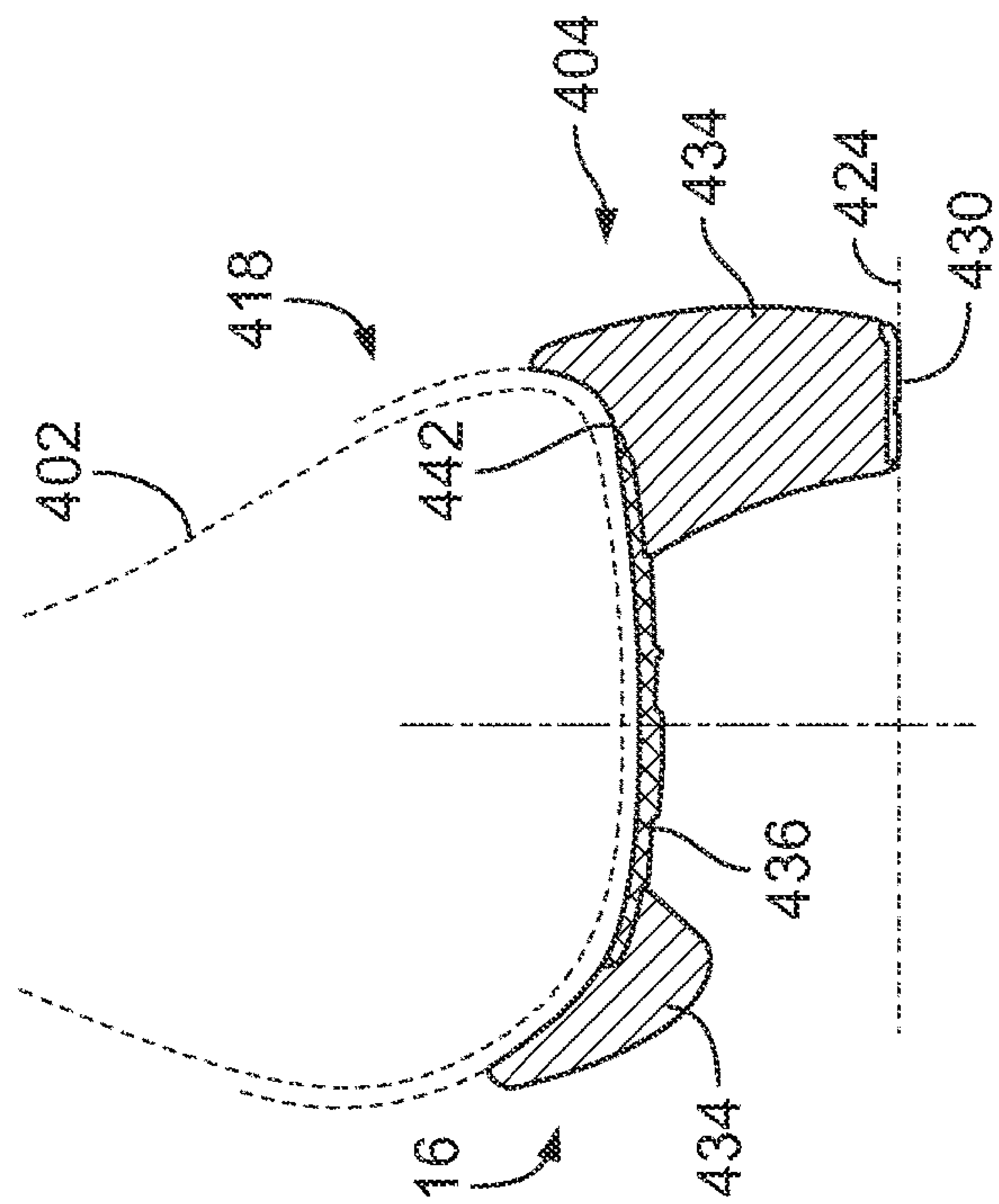
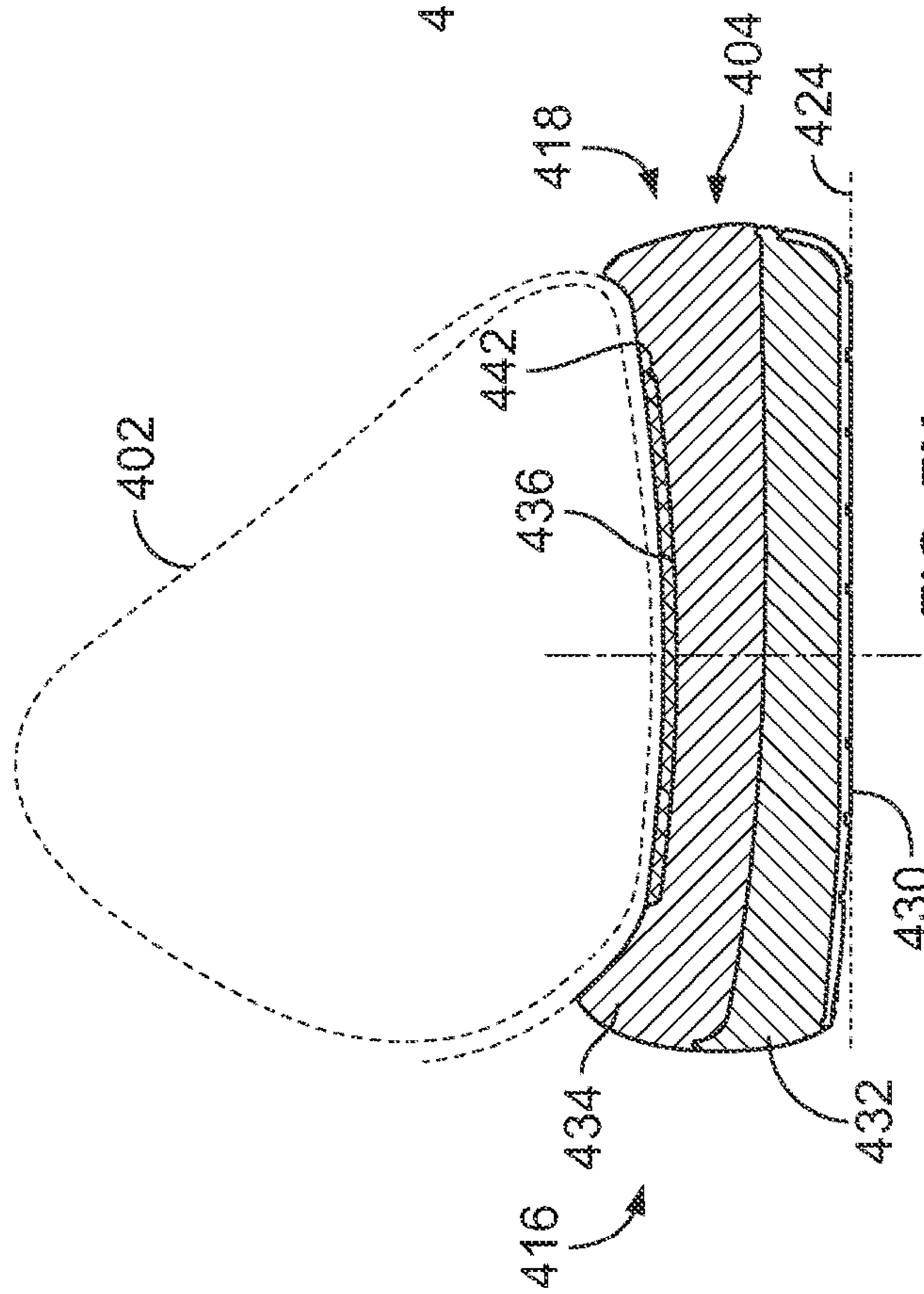


FIG. 7I



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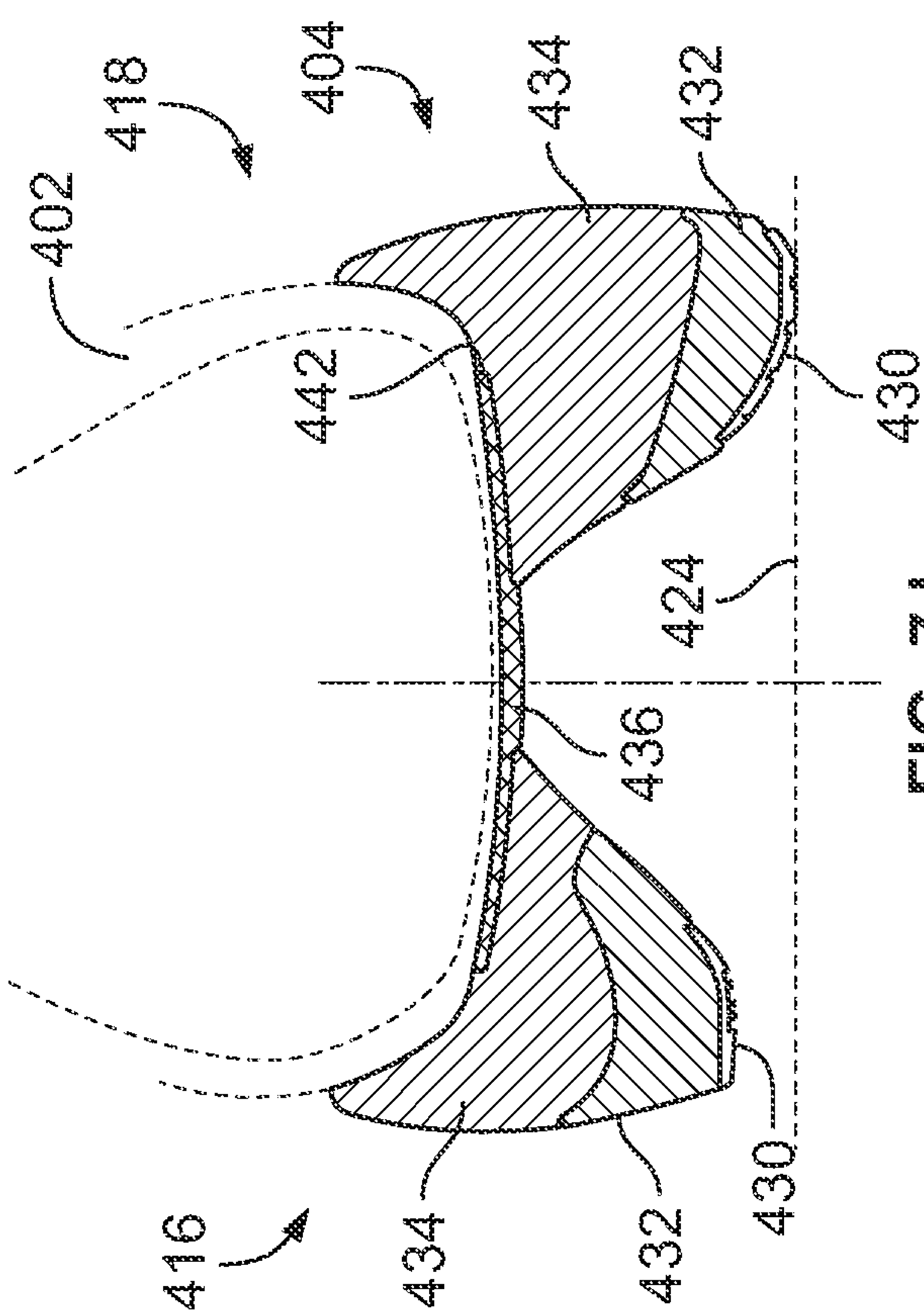

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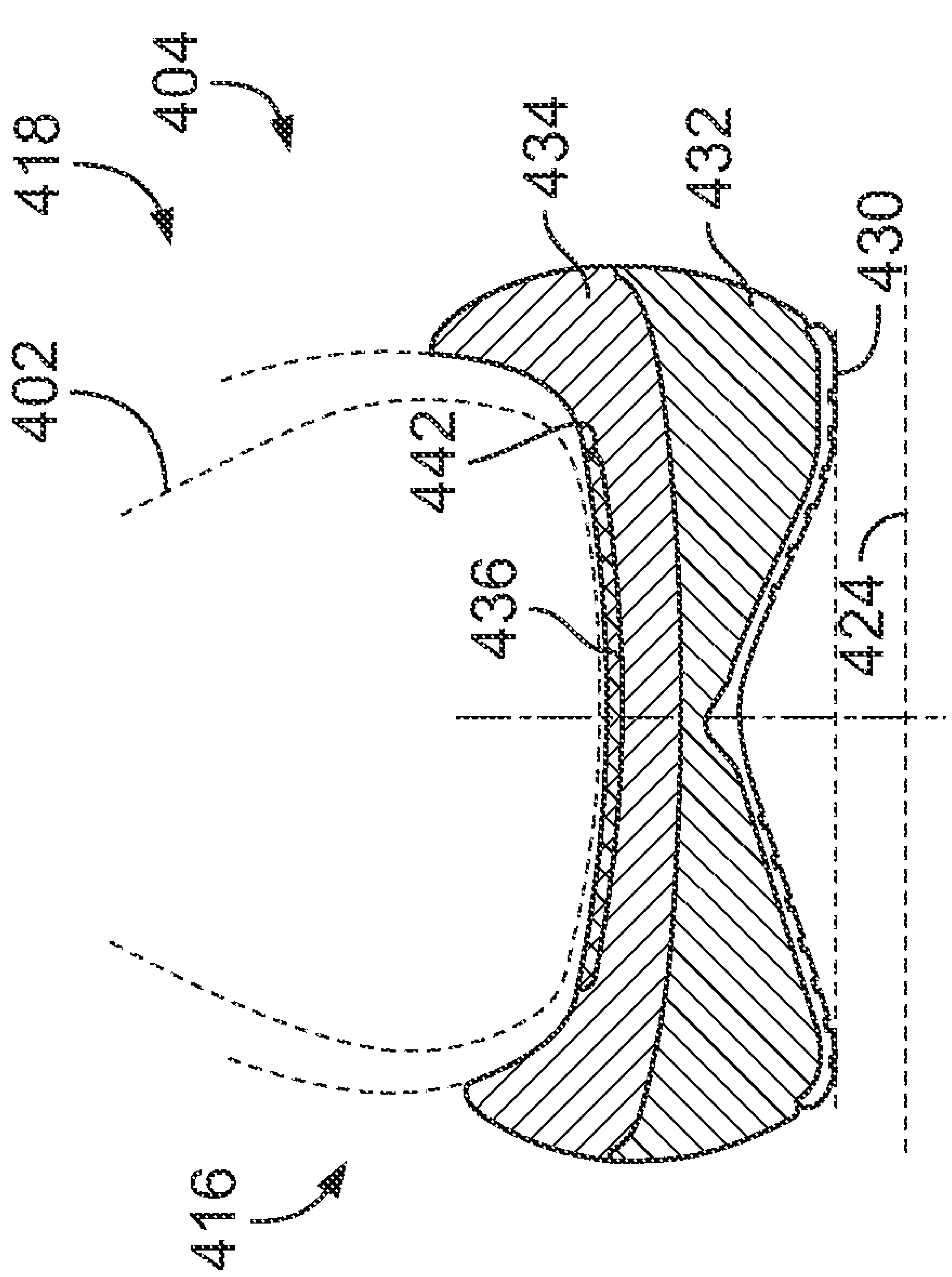

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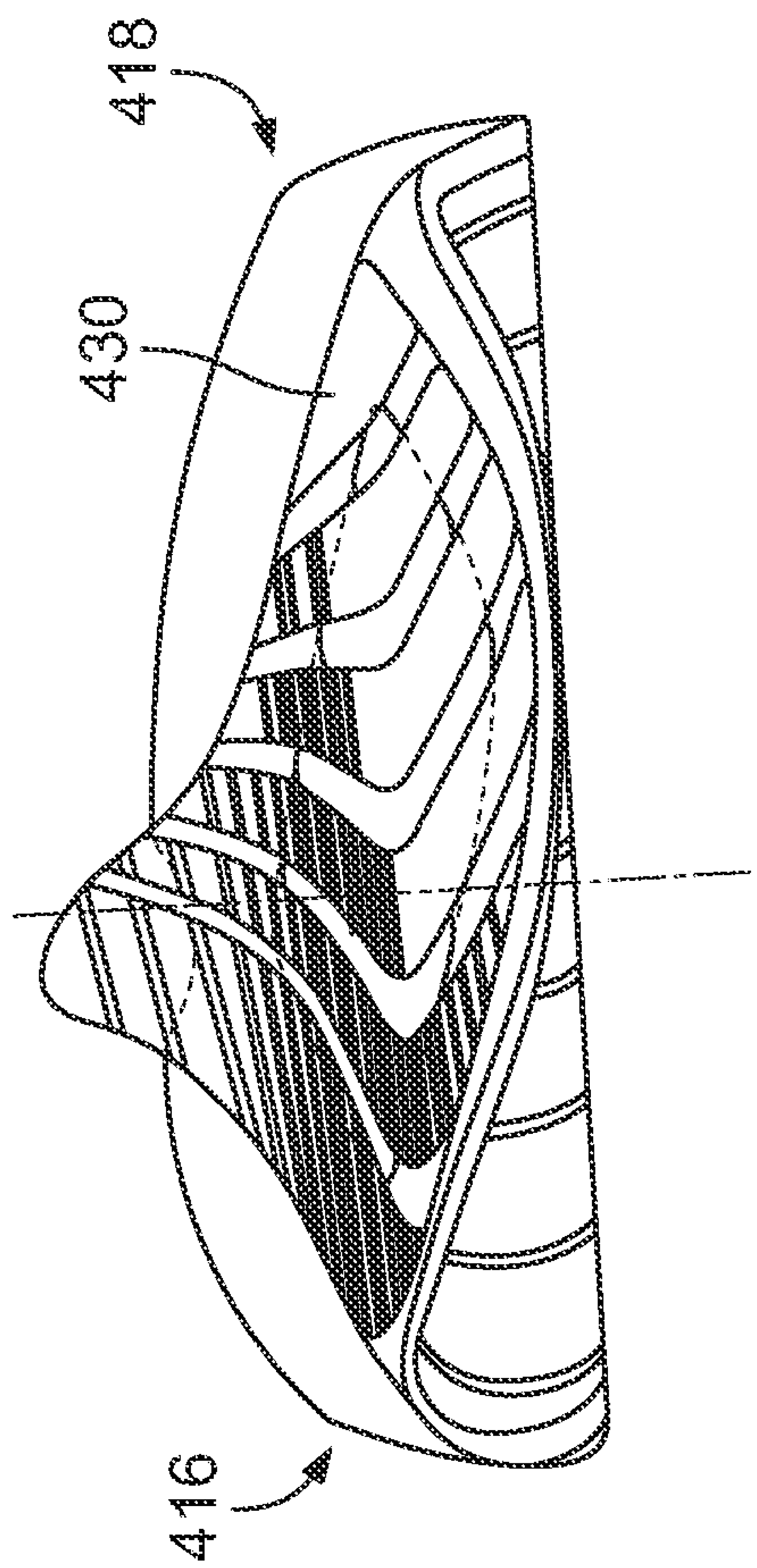

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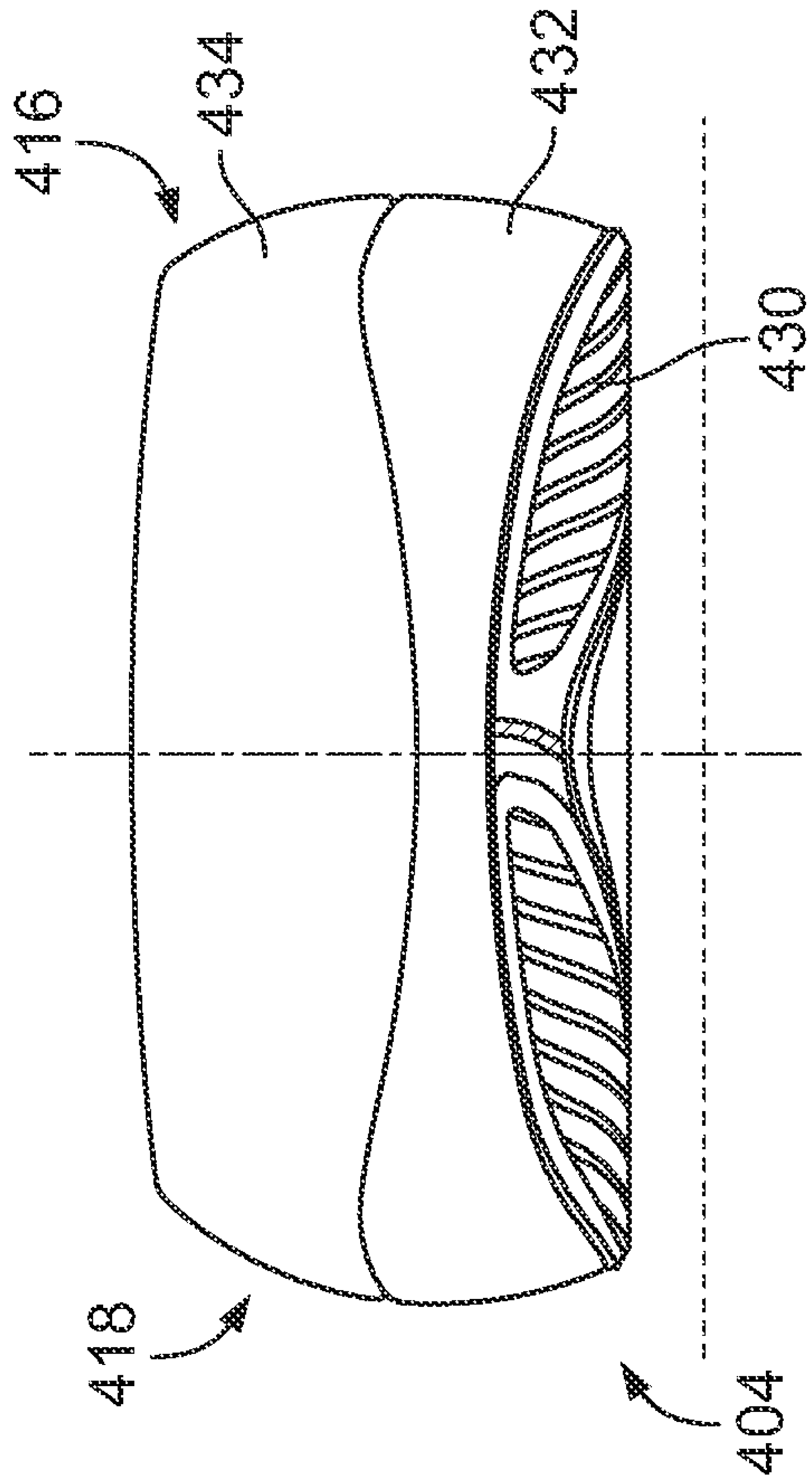


FIG. 7M

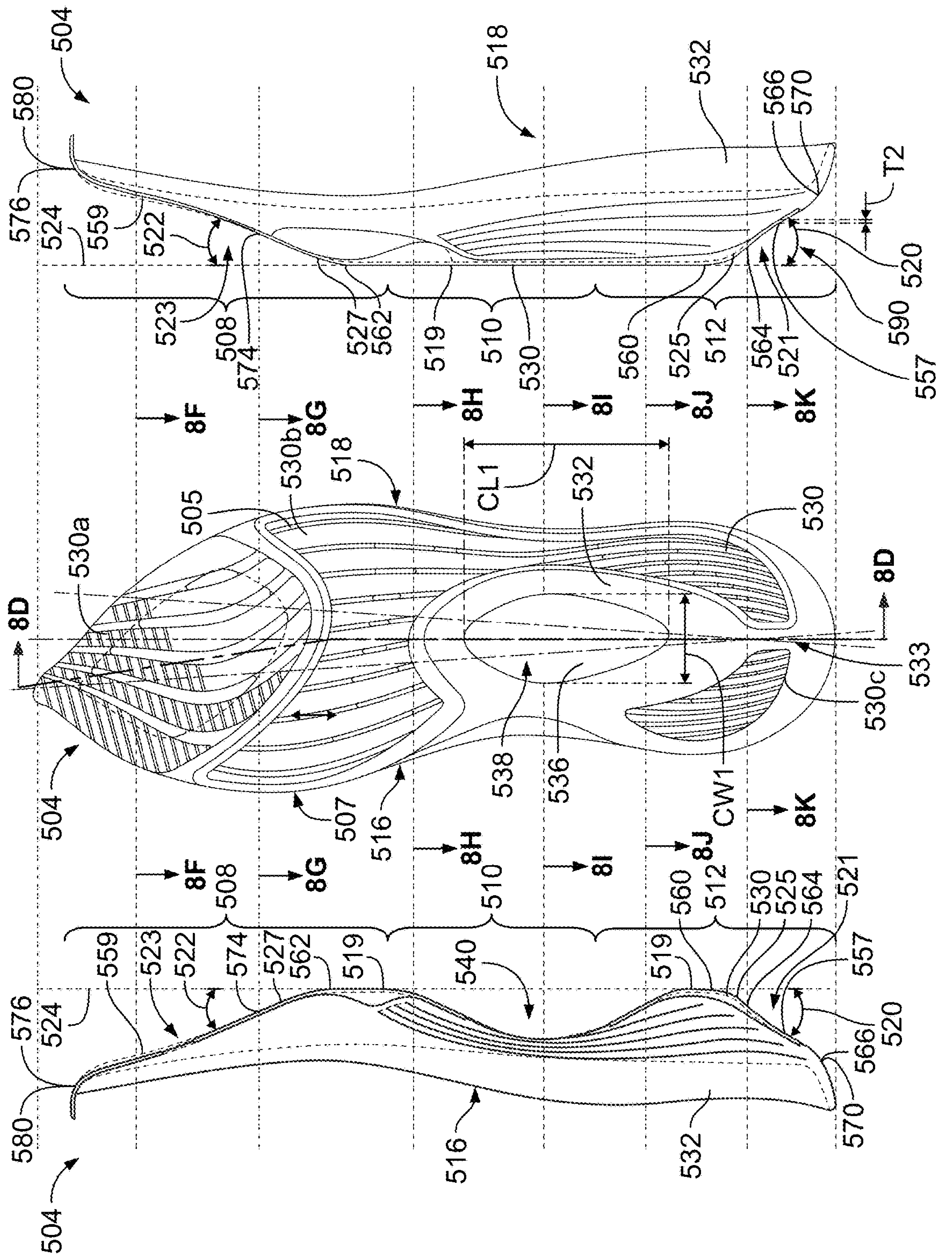
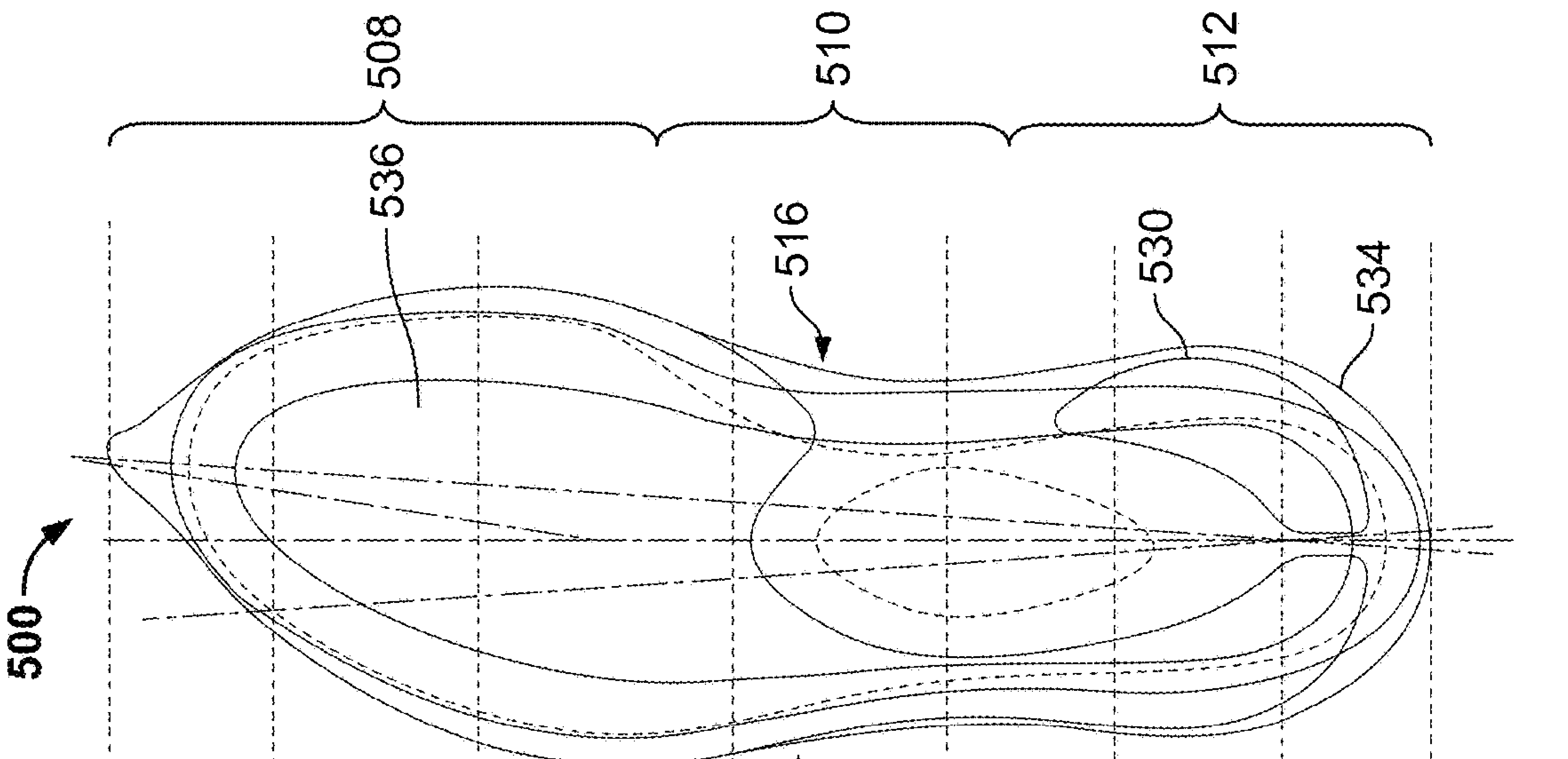


FIG. 8A

FIG. 8B

FIG. 8C



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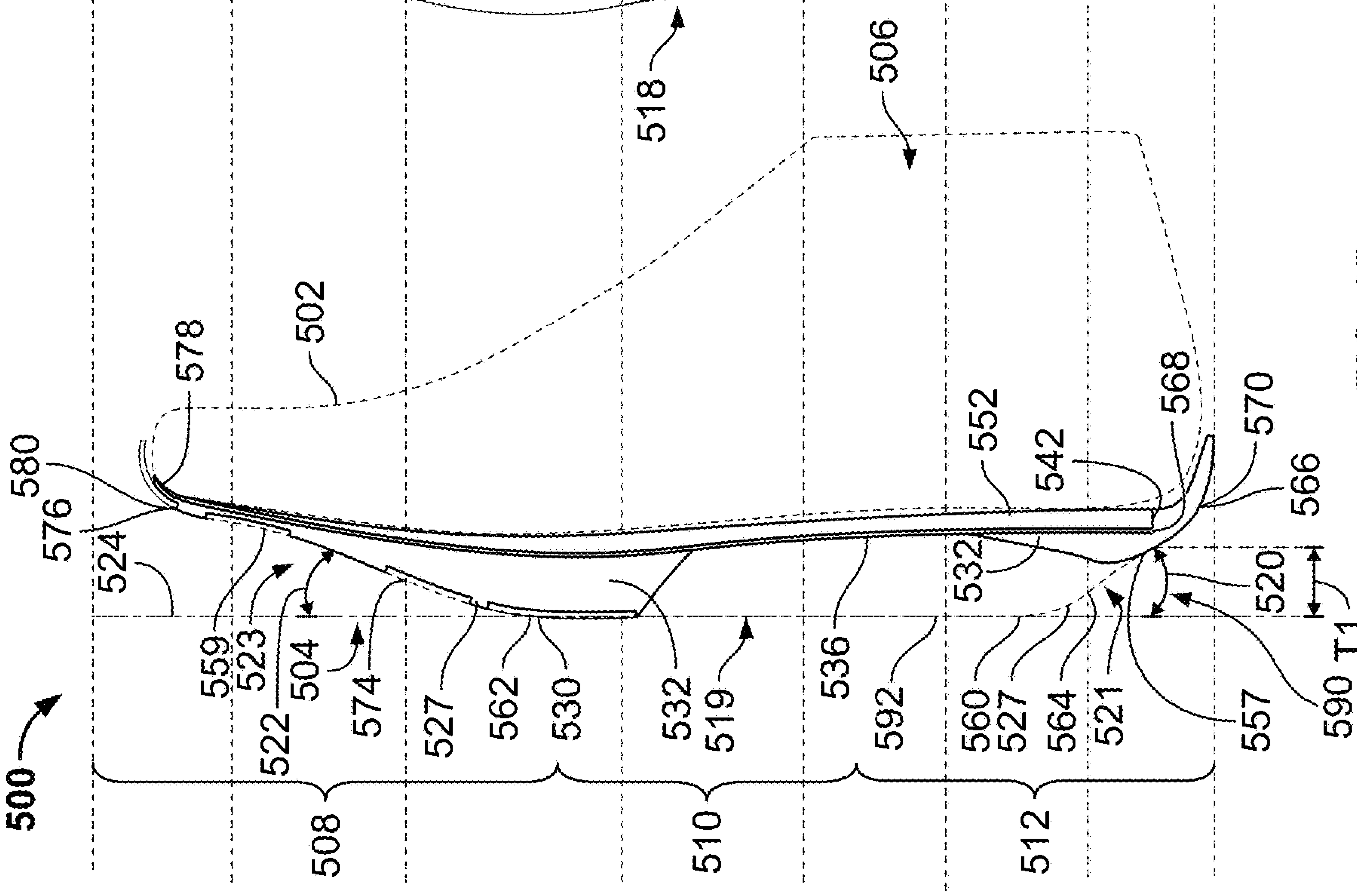

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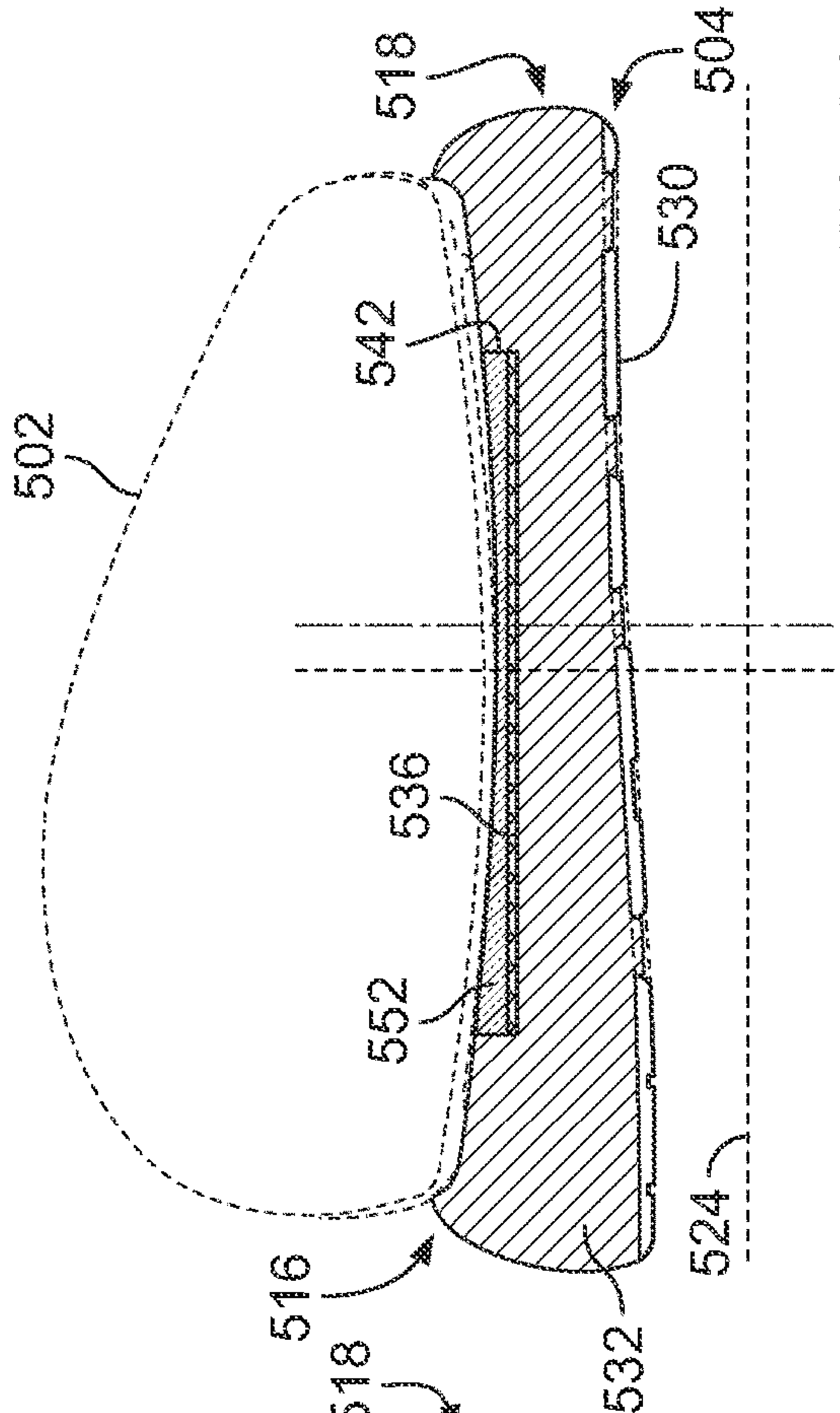

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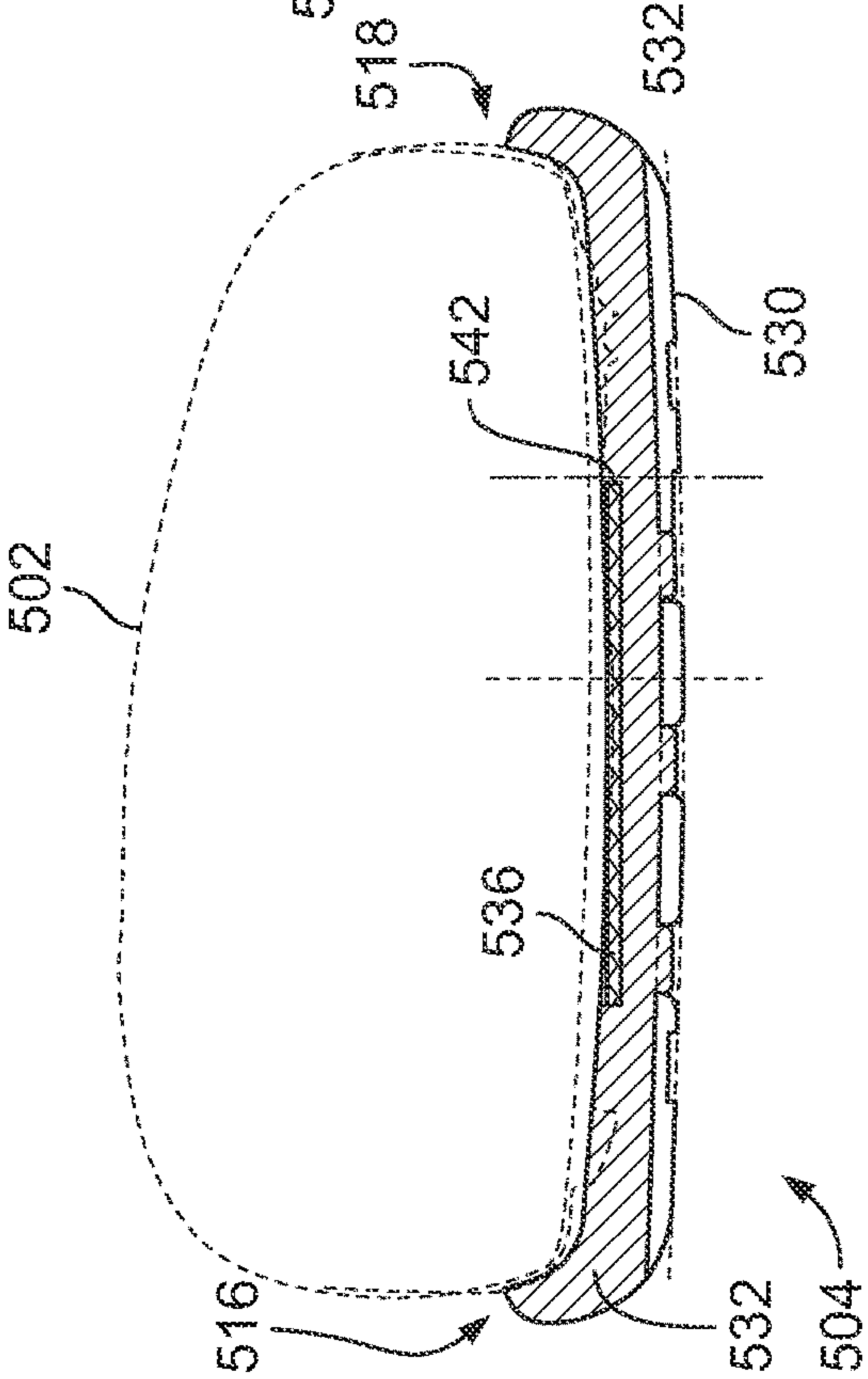

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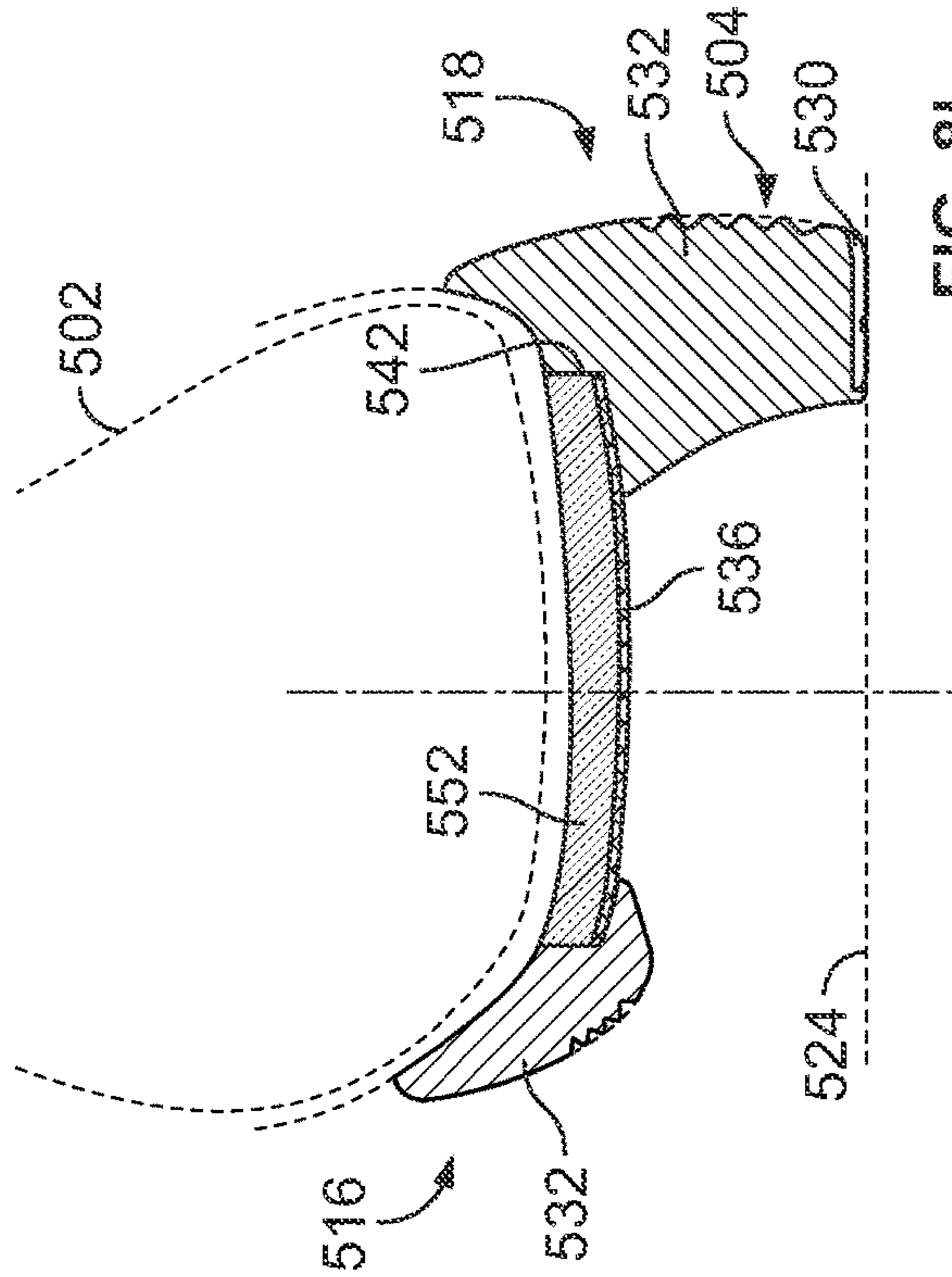

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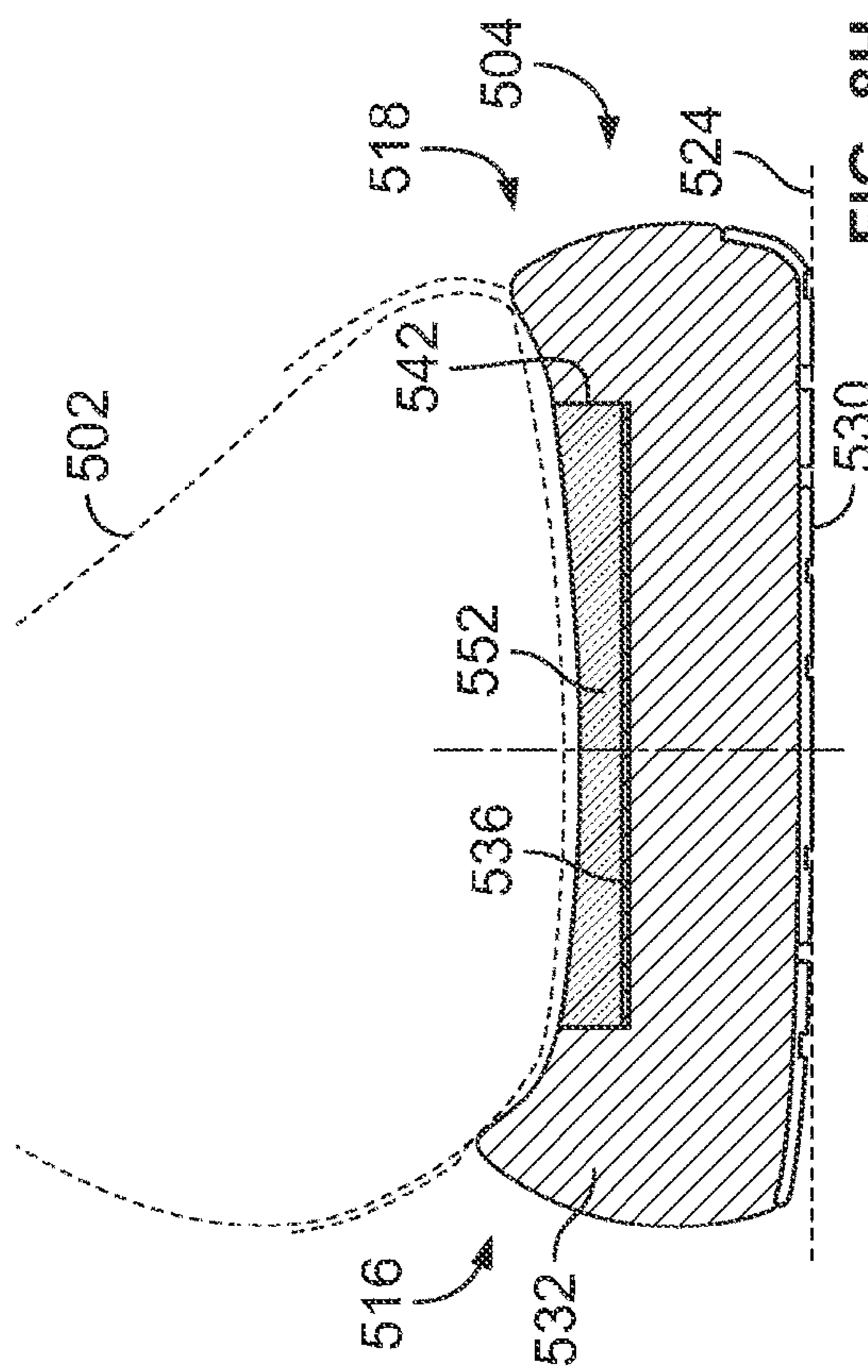

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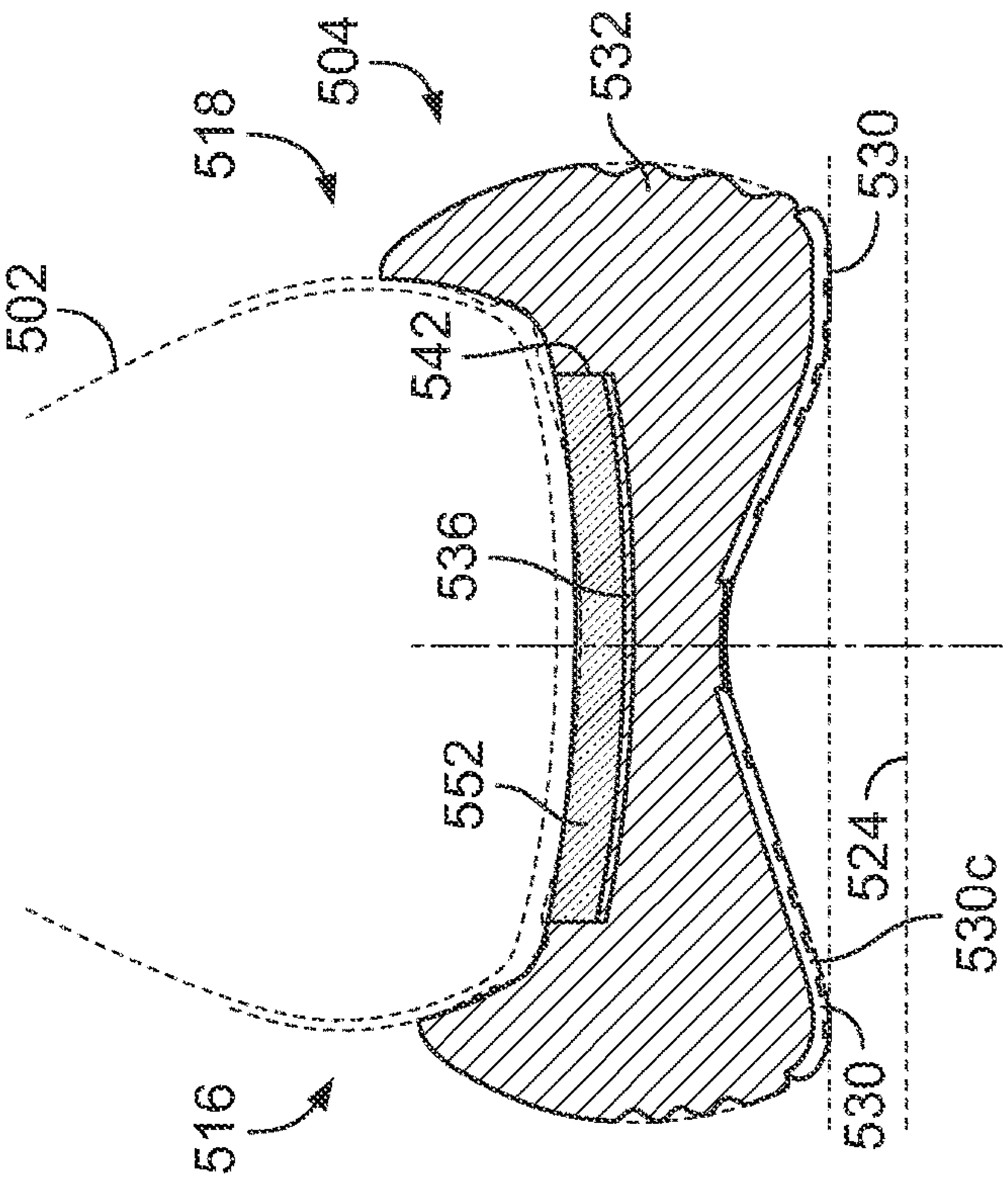

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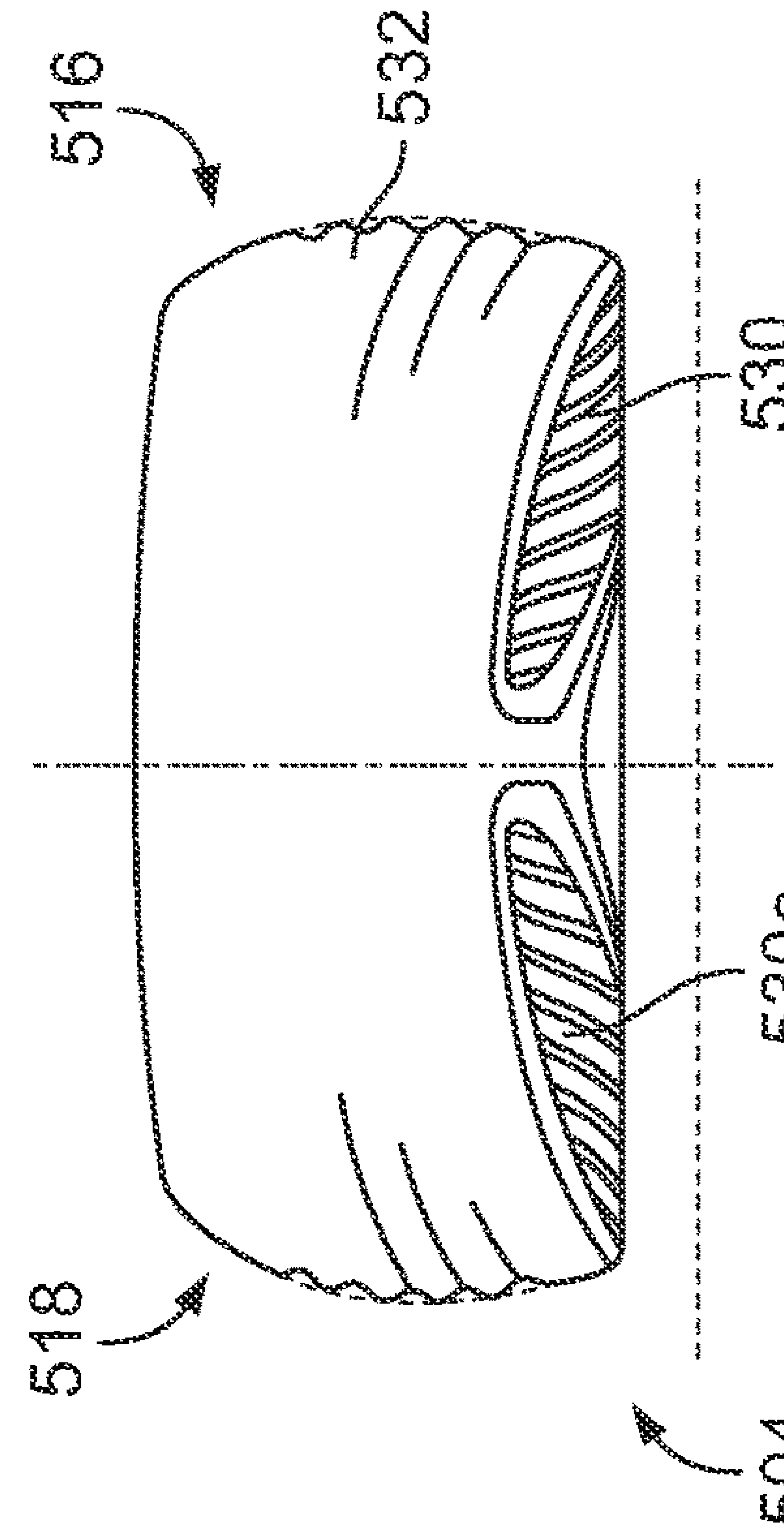

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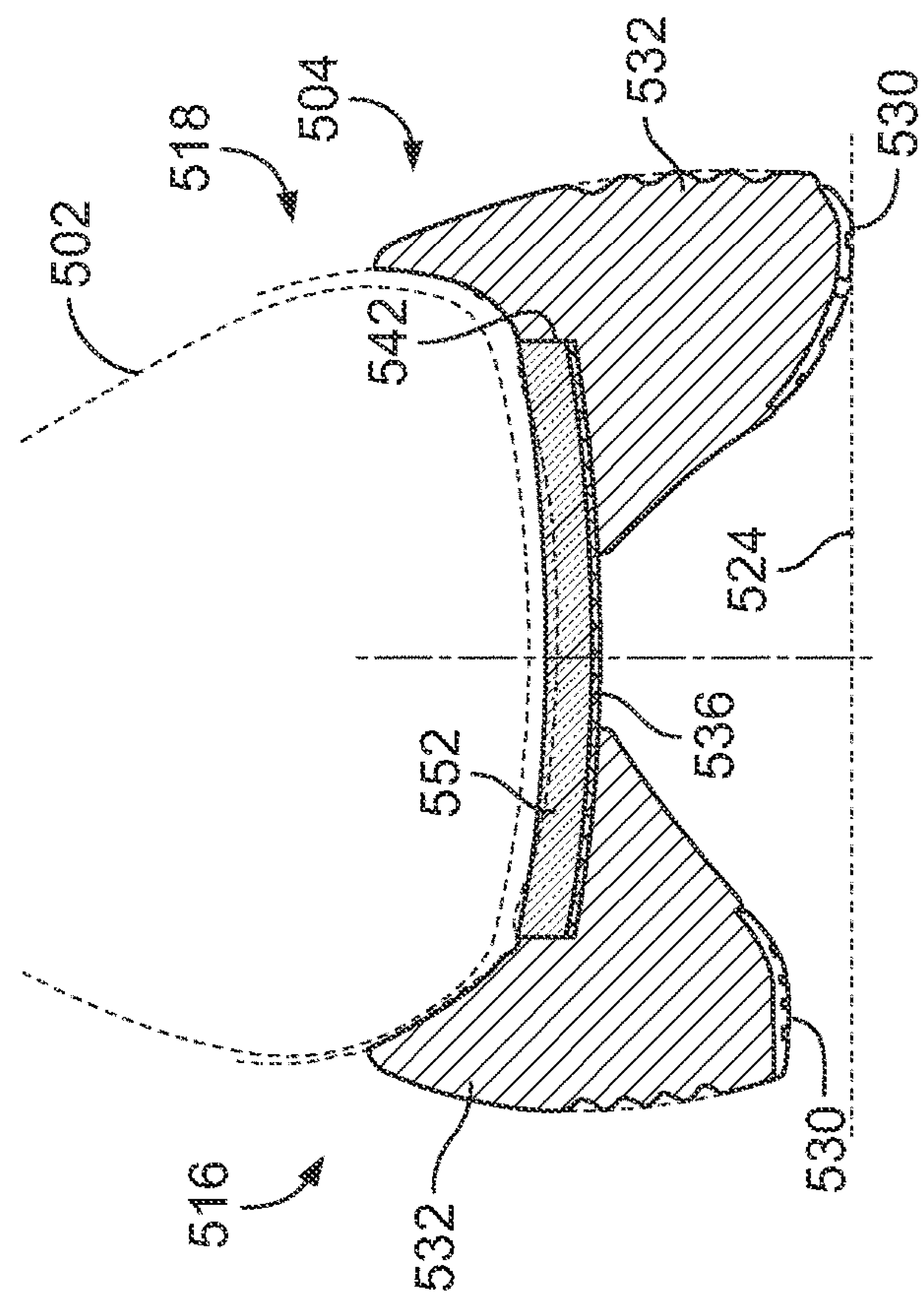
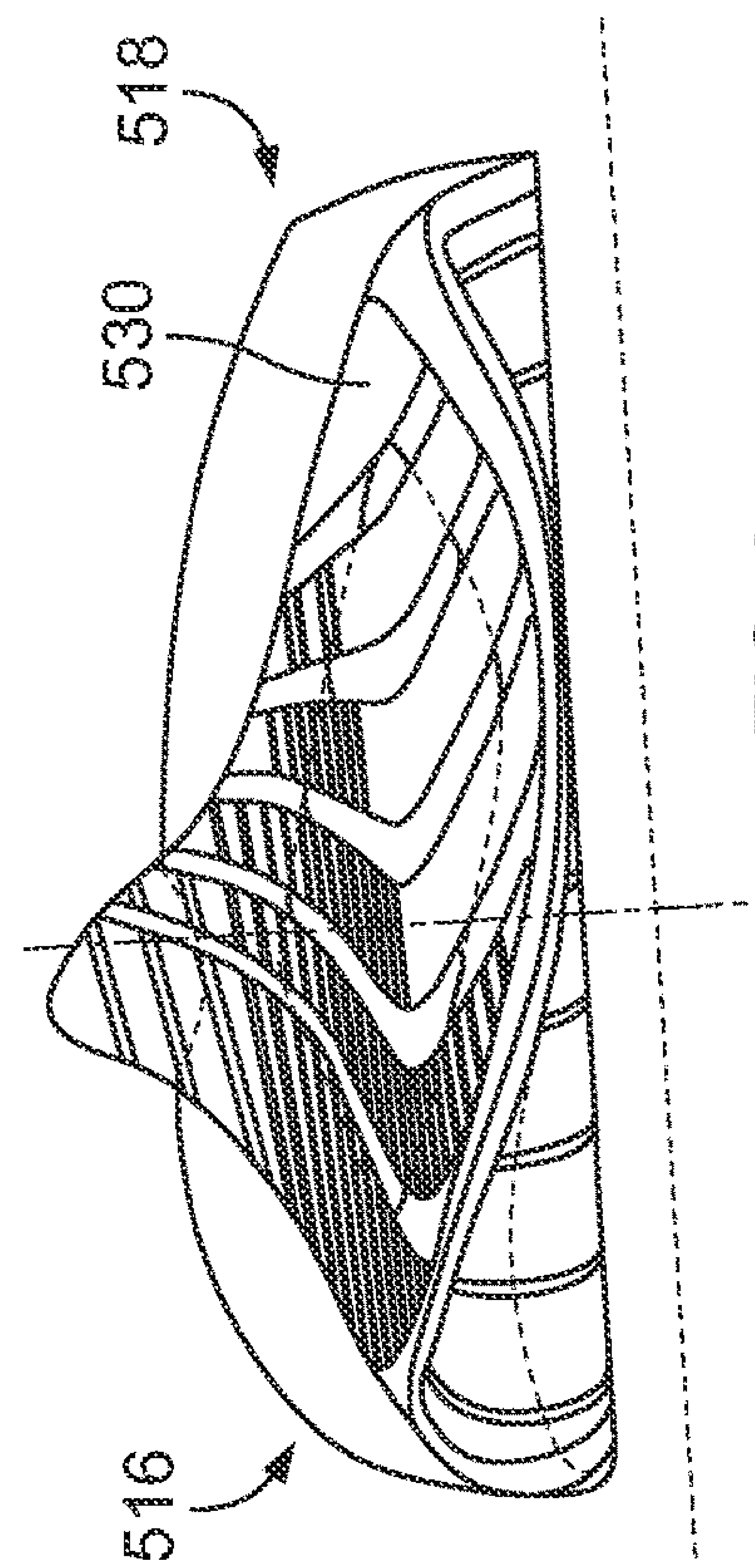


FIG. 8J



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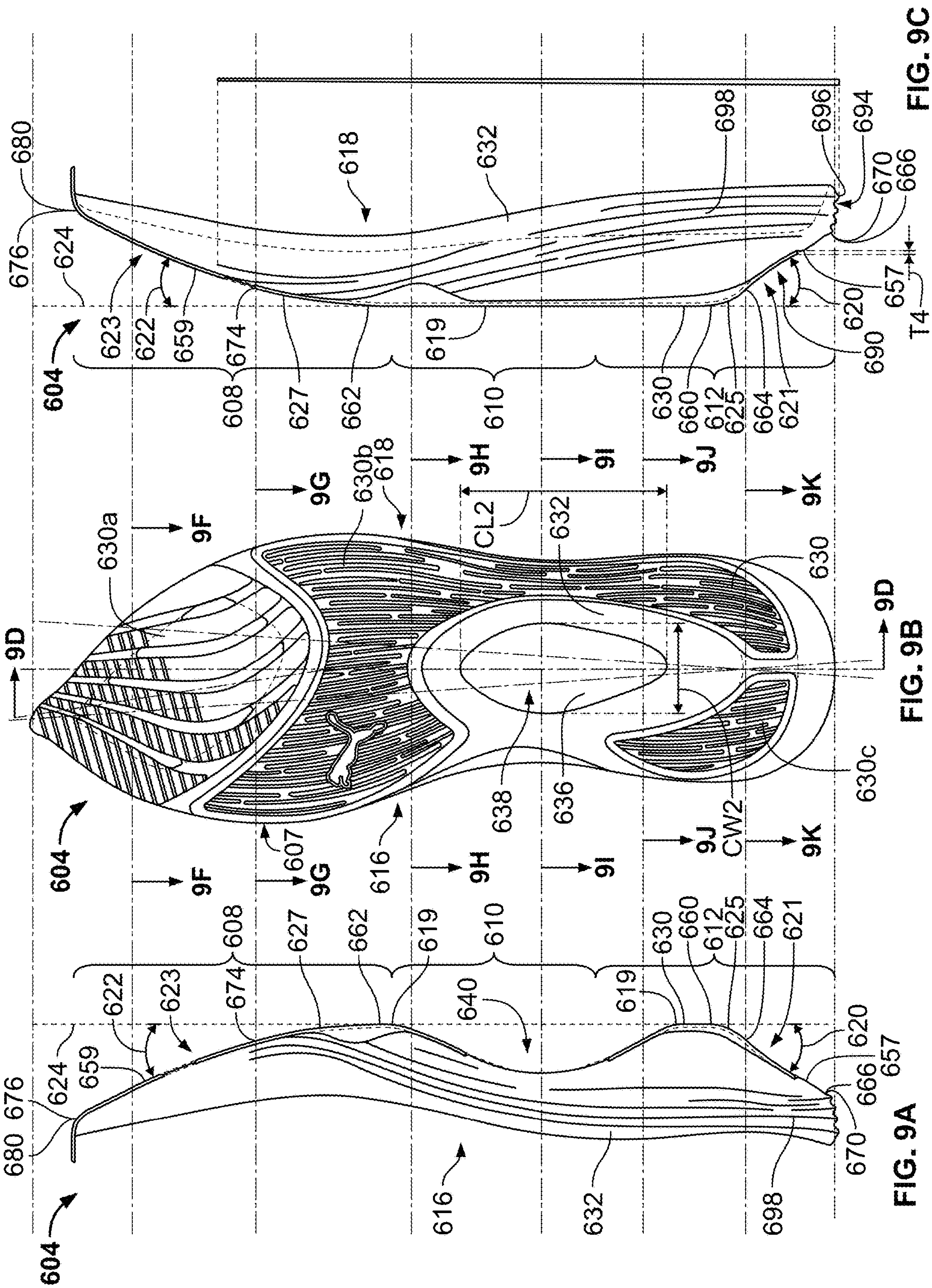

FIG. 9A

FIG. 9B

FIG. 9C

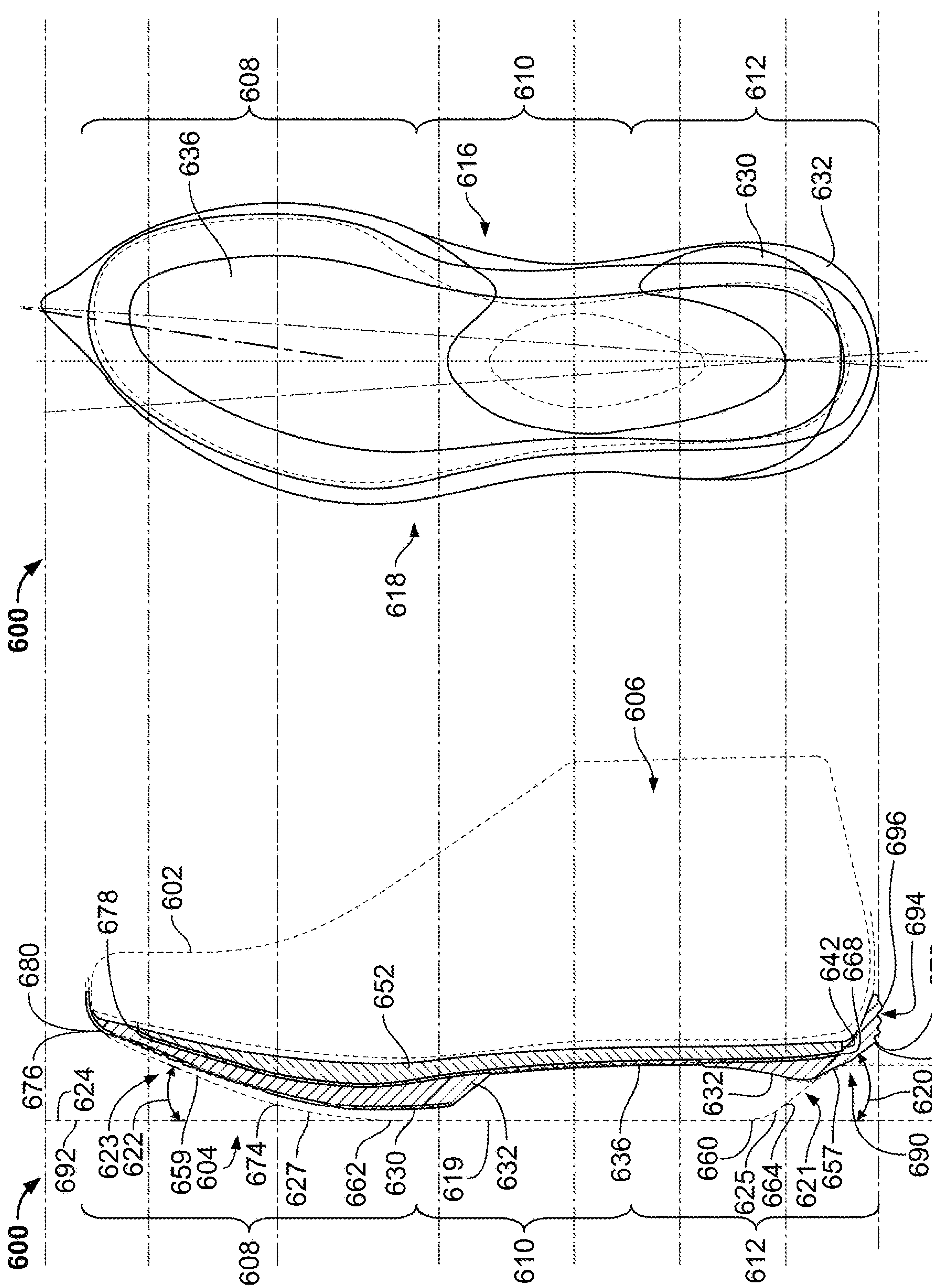
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FIG. 9D

FIG. 9E

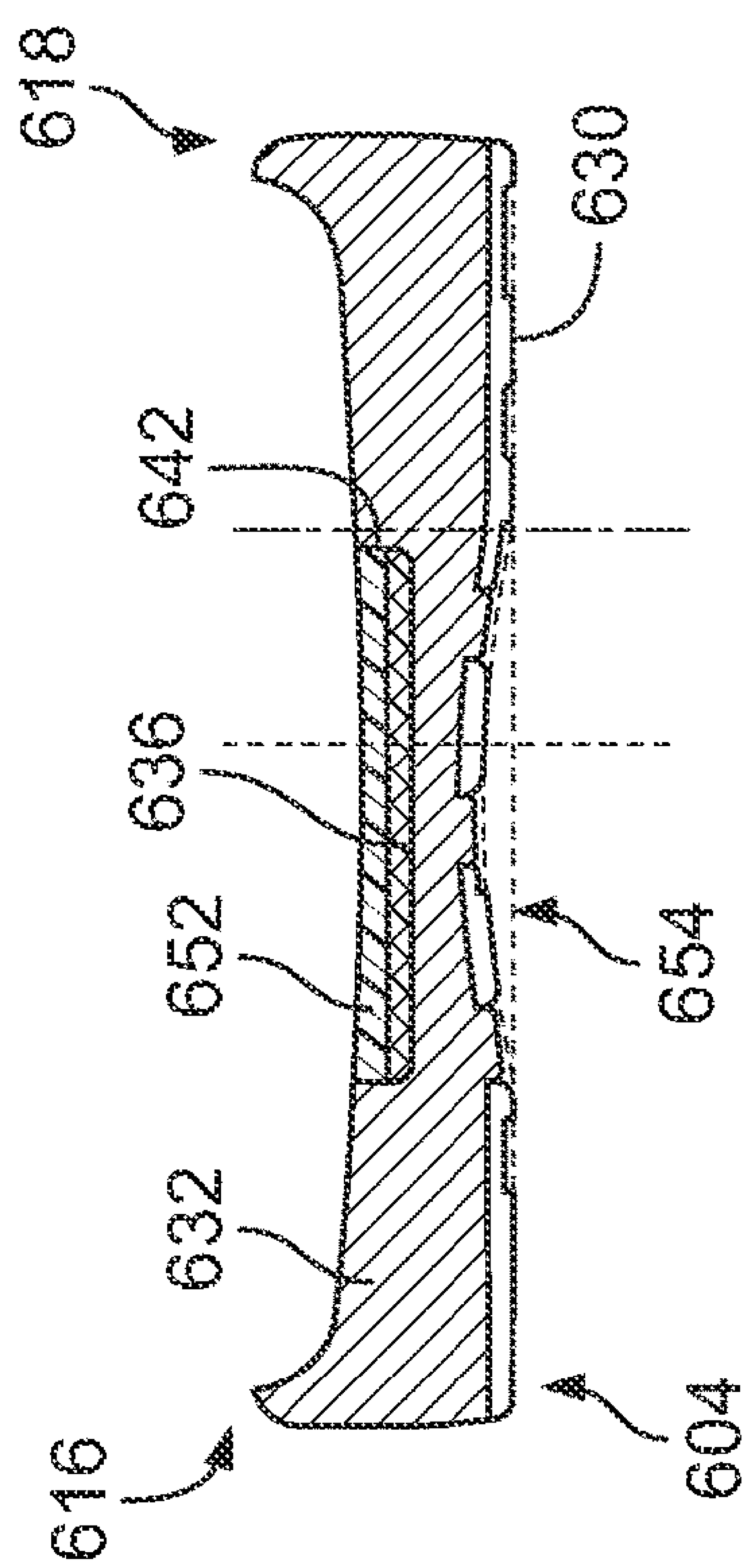

FIG. 9F

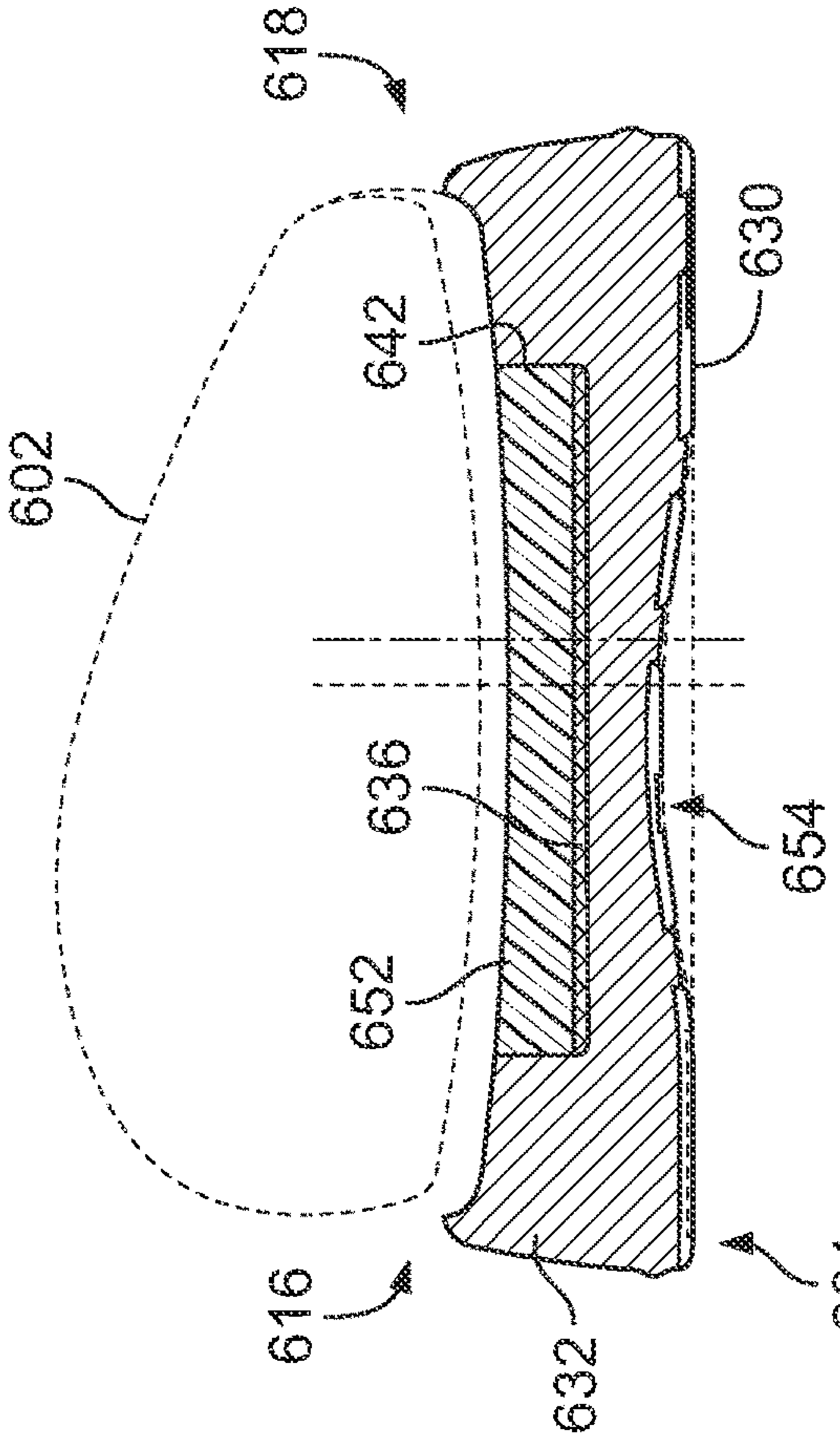

FIG. 9G

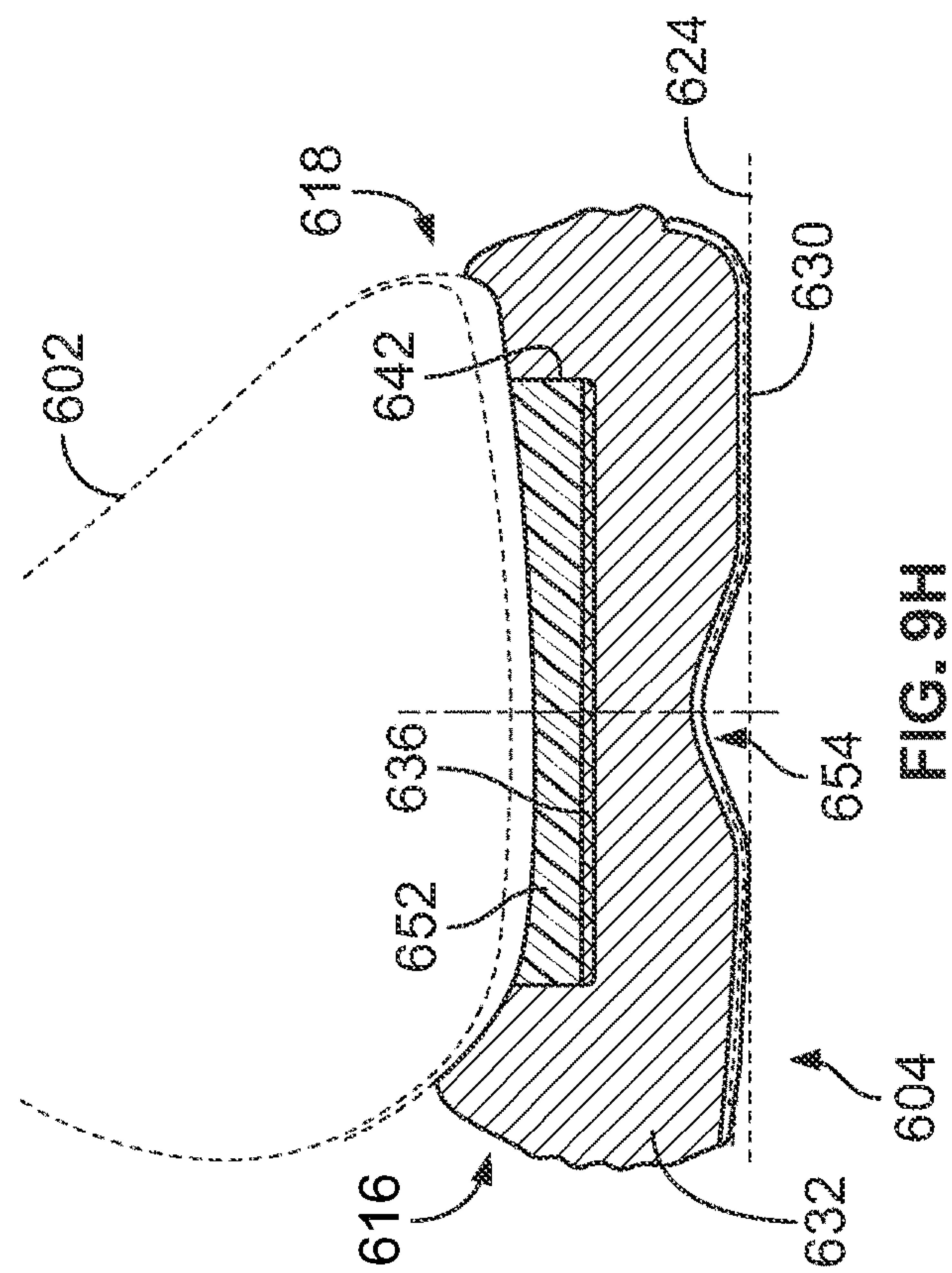

FIG. 9H

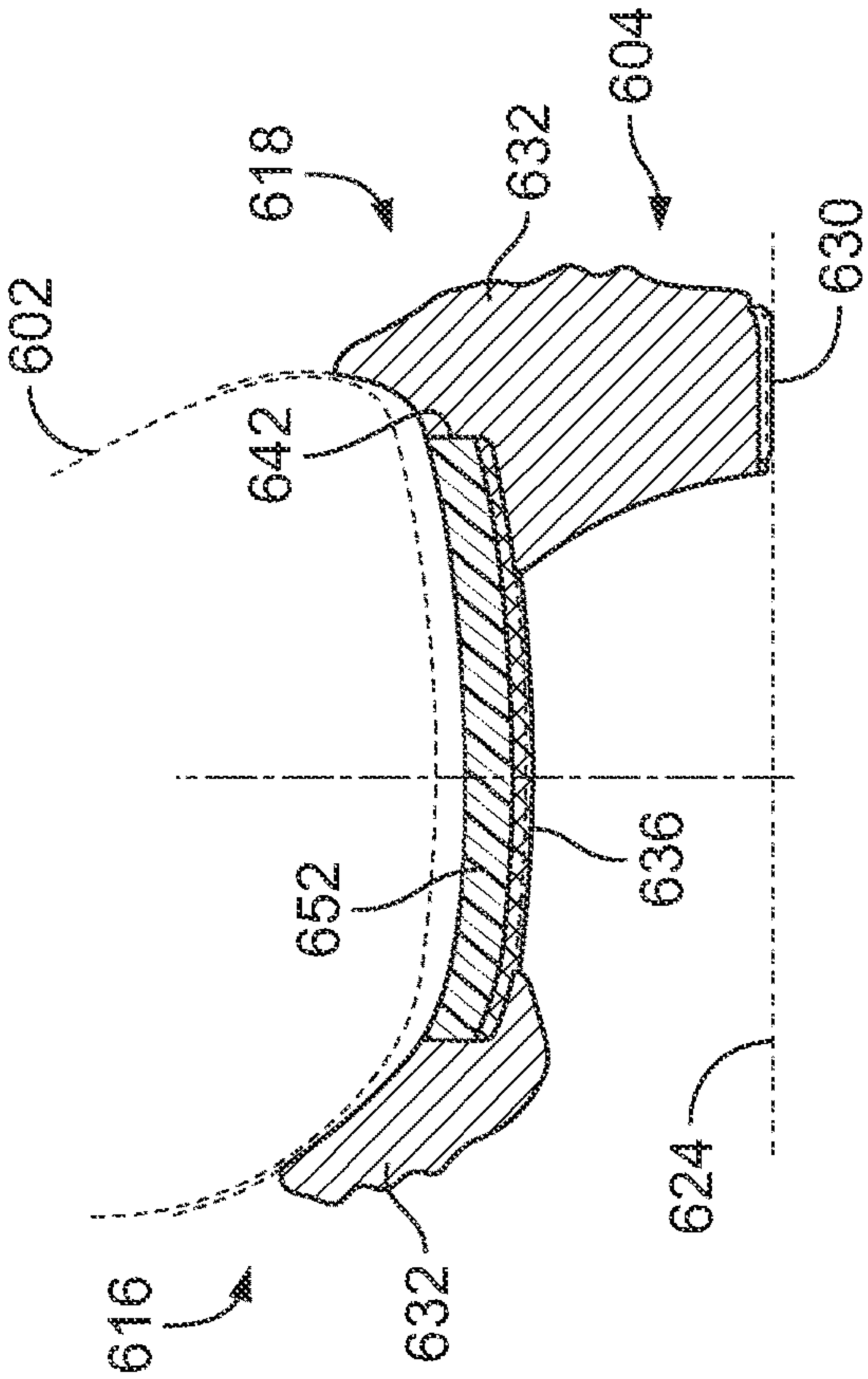

FIG. 9I

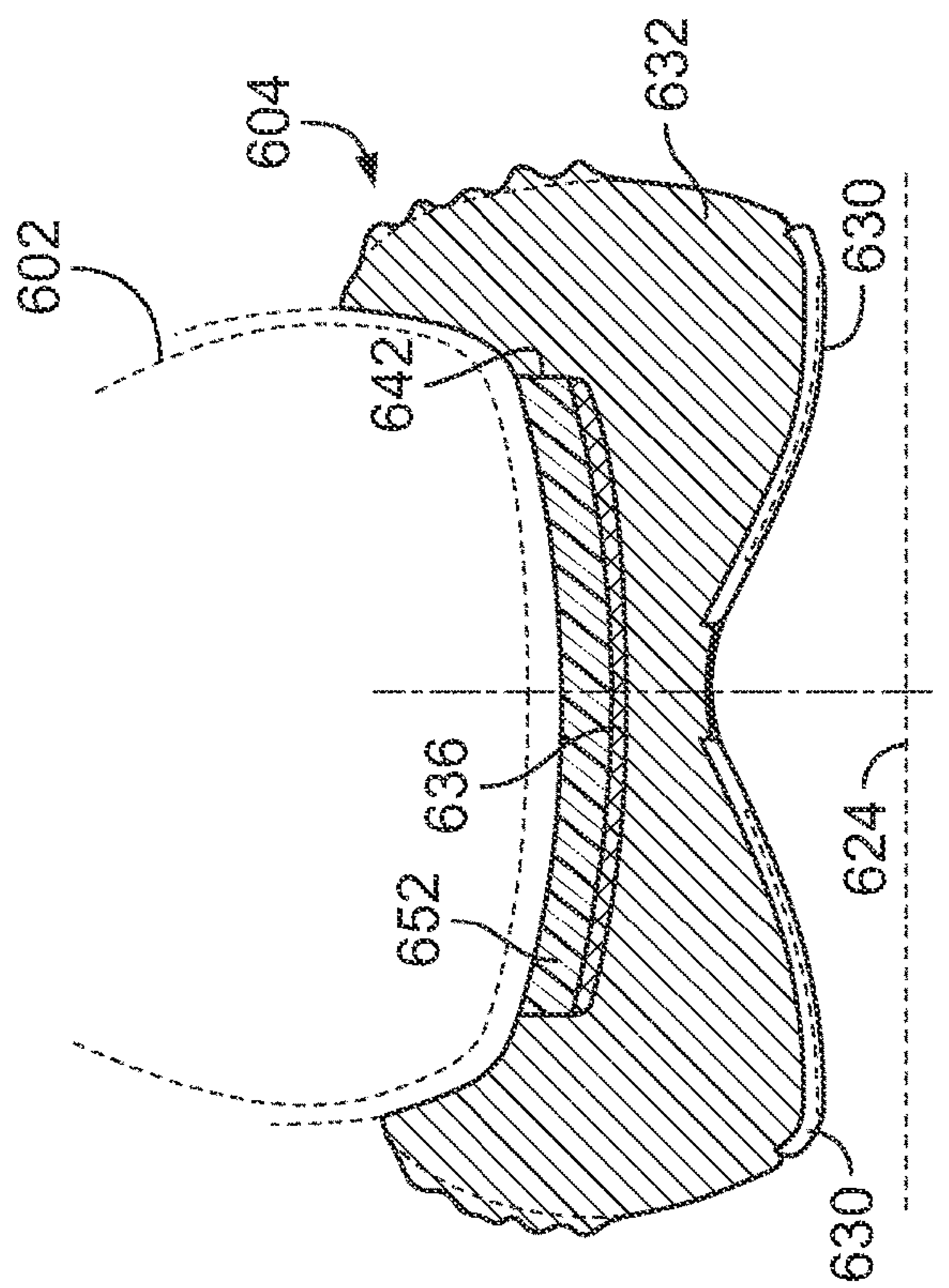

FIG. 9K

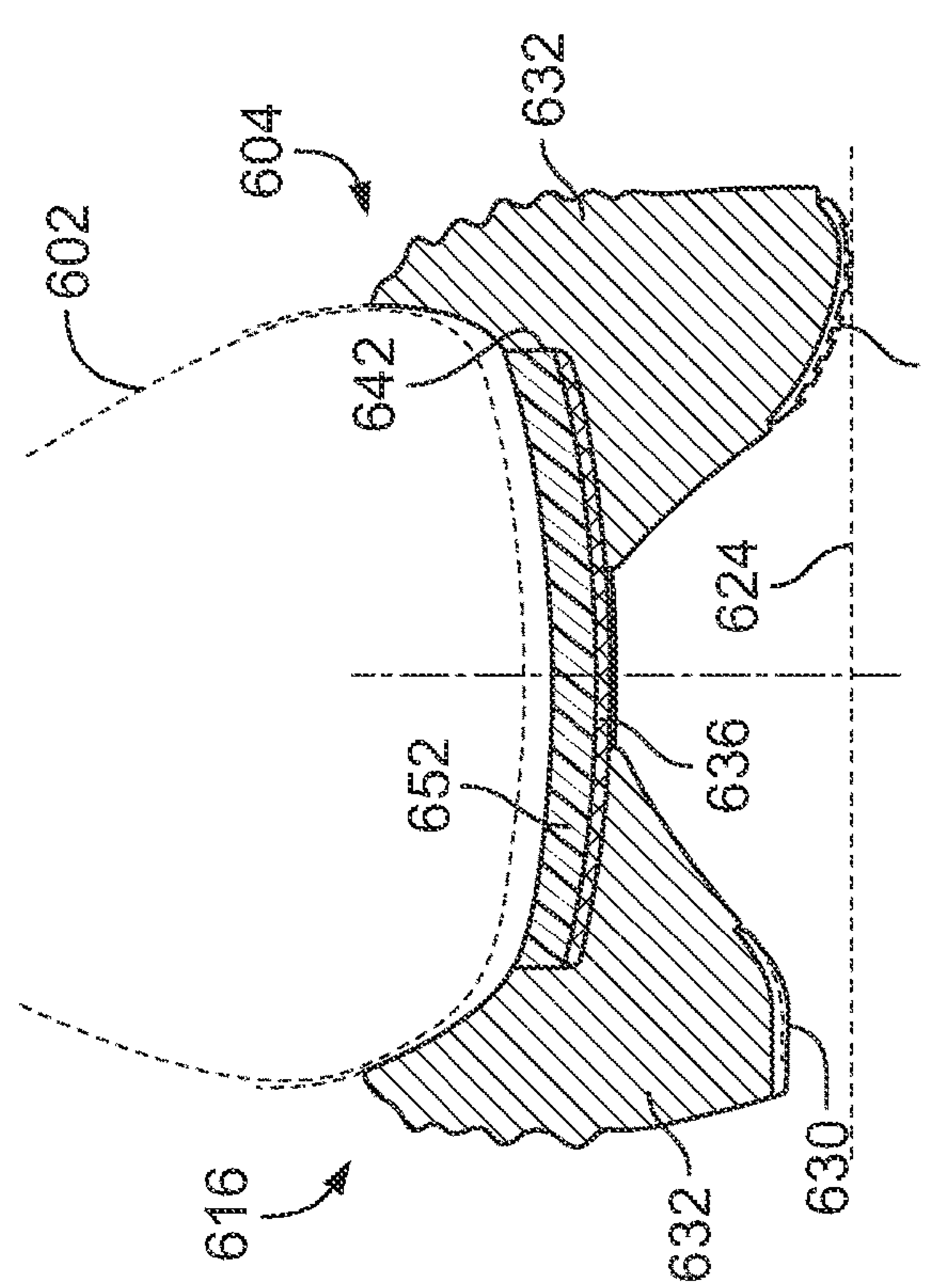

FIG. 9J

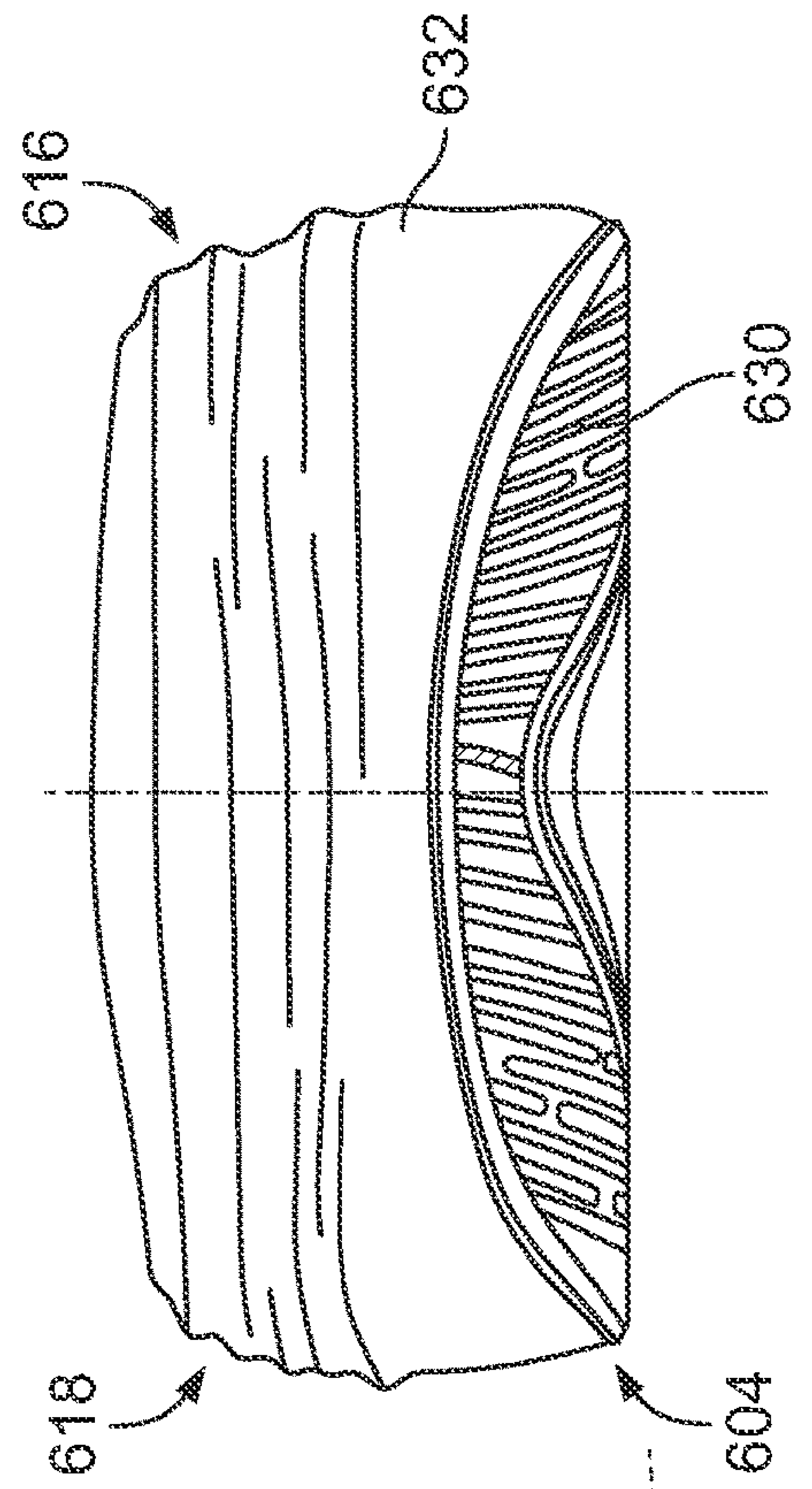

FIG. 9M

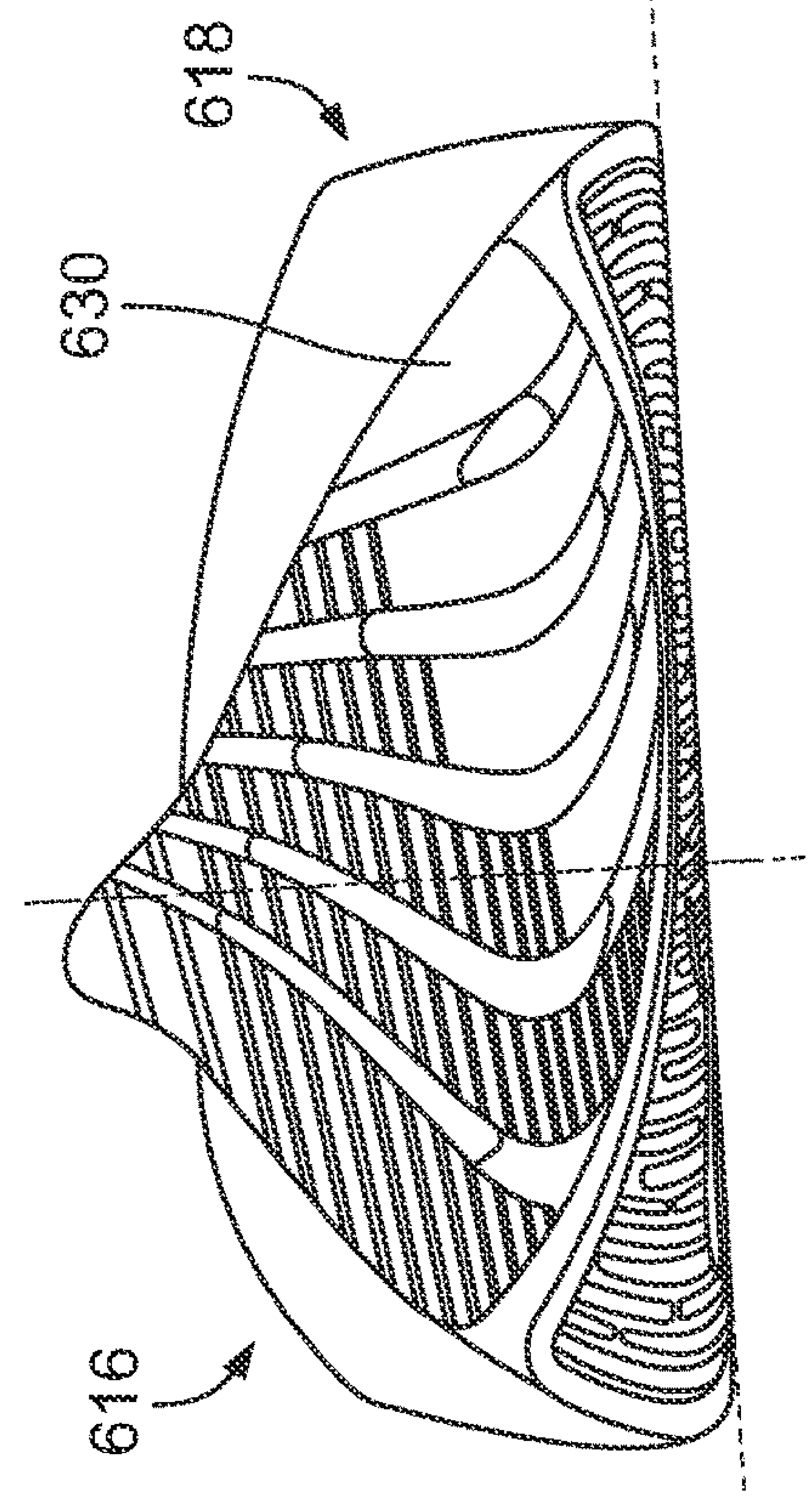

FIG. 9L

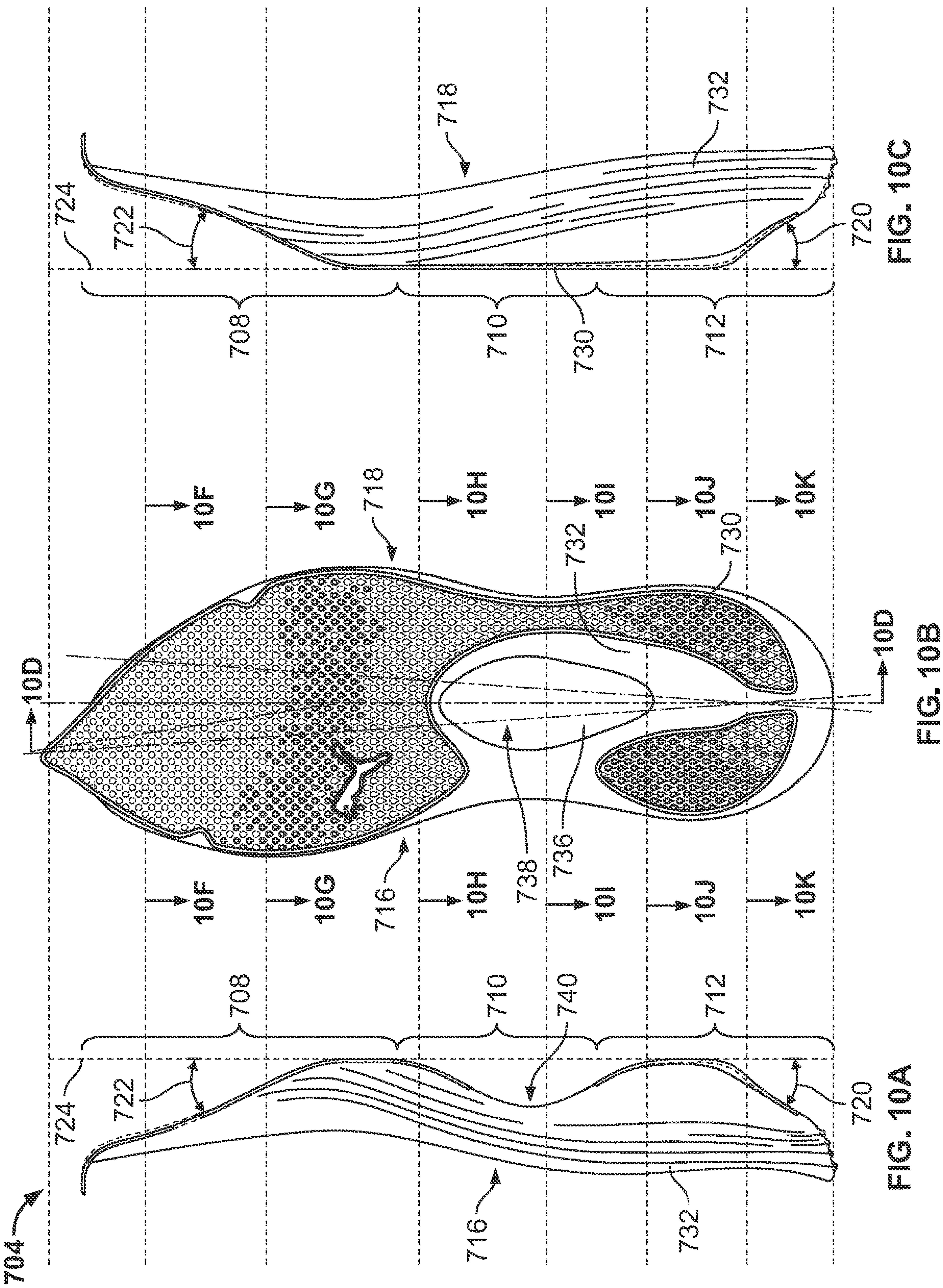

FIG. 10A

FIG. 10B

FIG. 10C

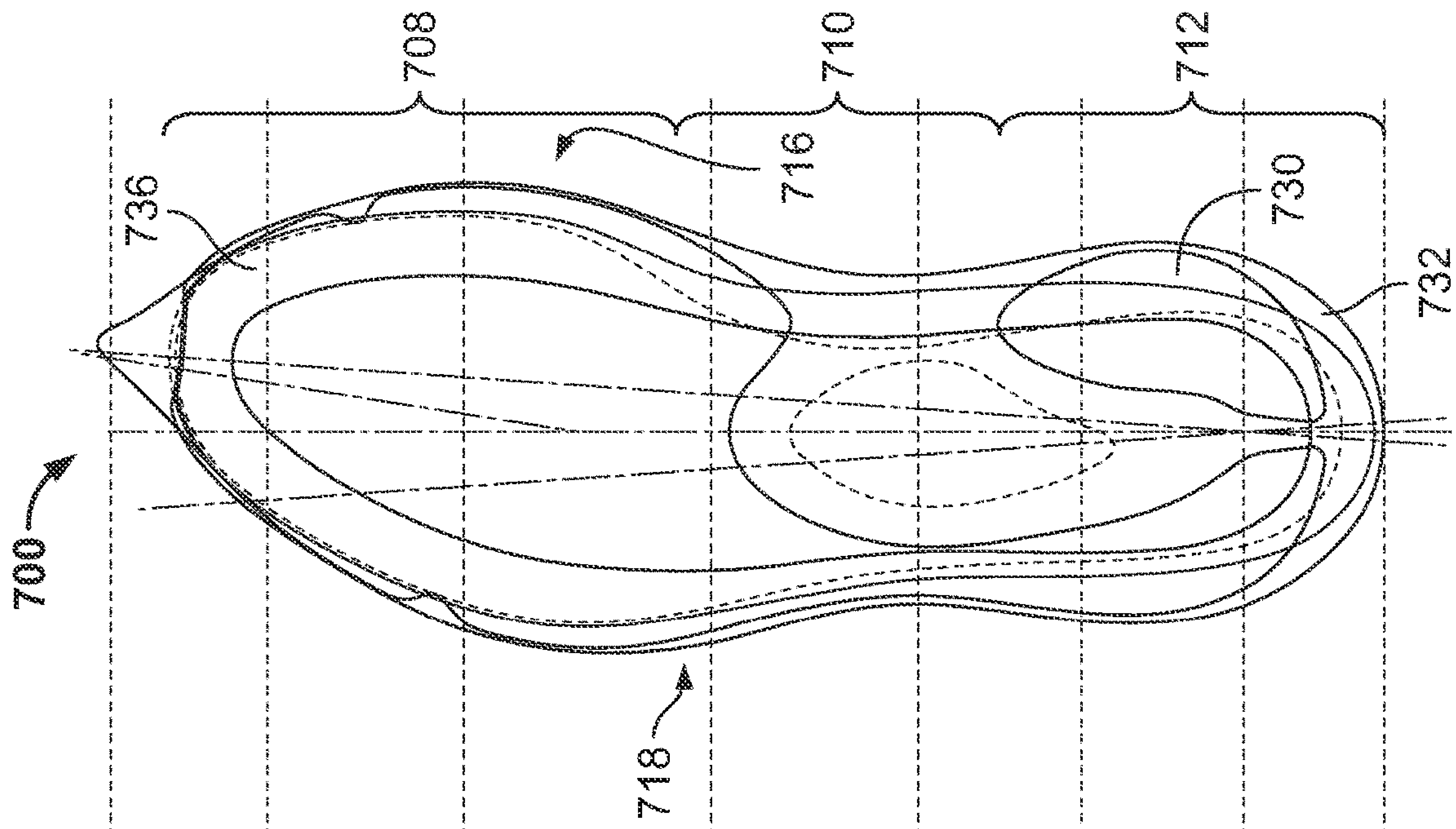

FIG. 10E

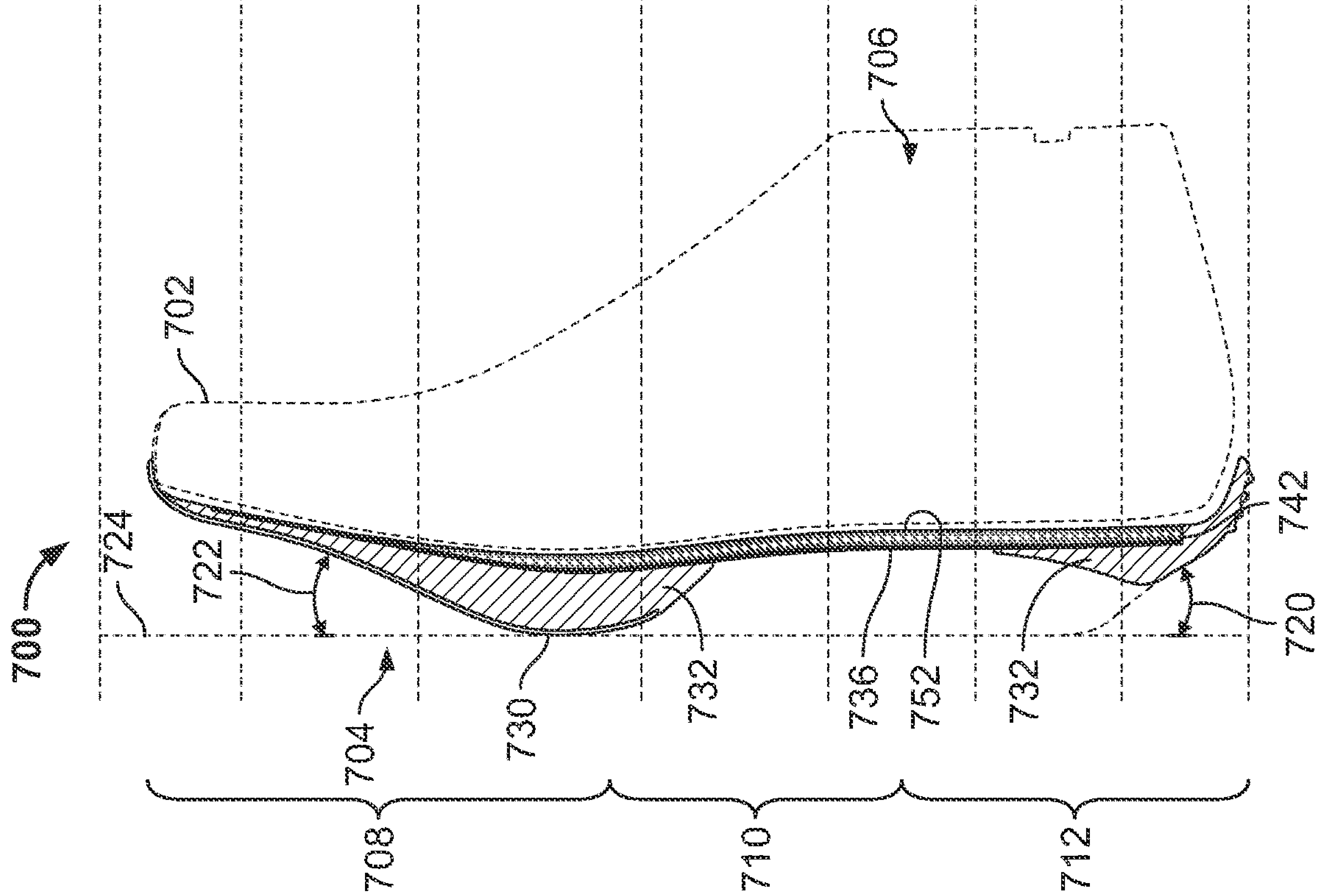

FIG. 10D

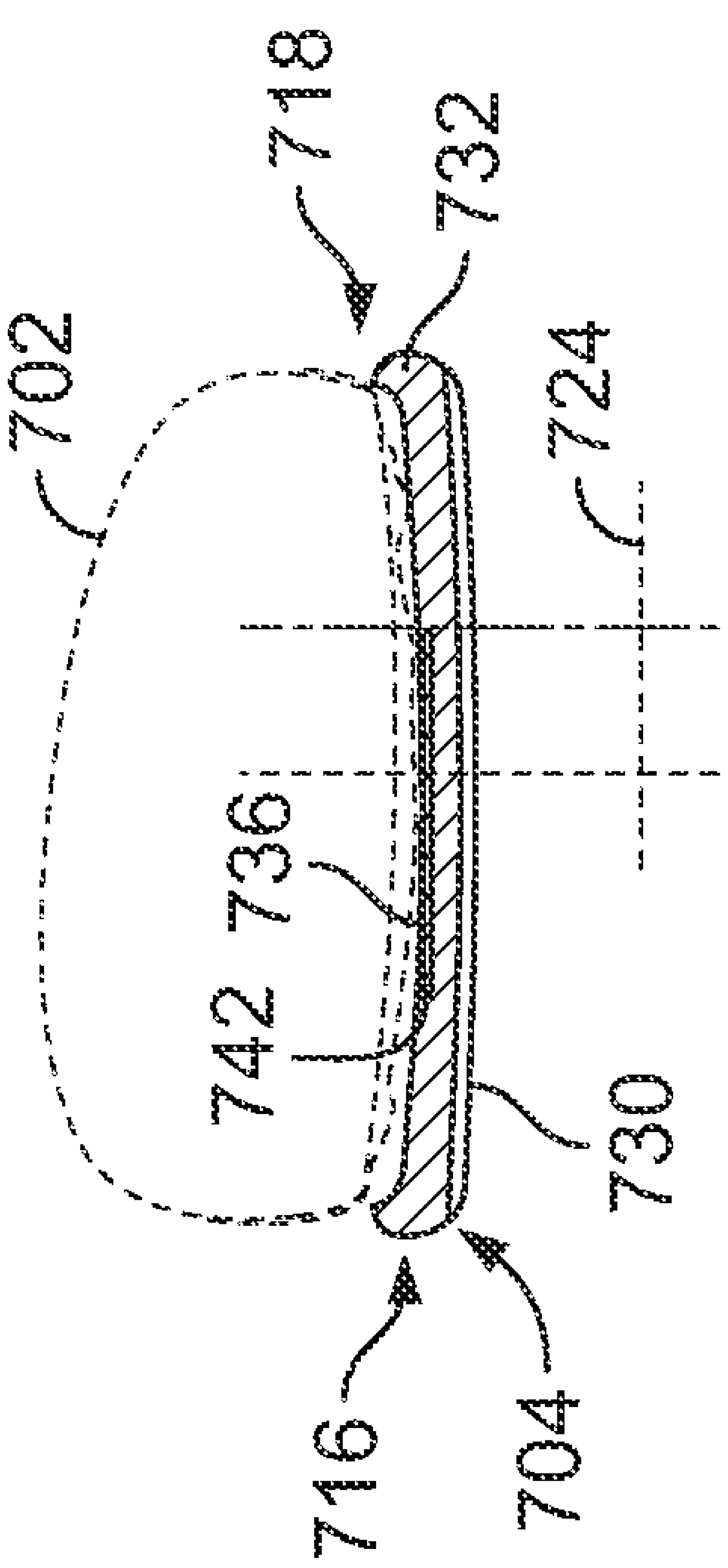

FIG. 10F

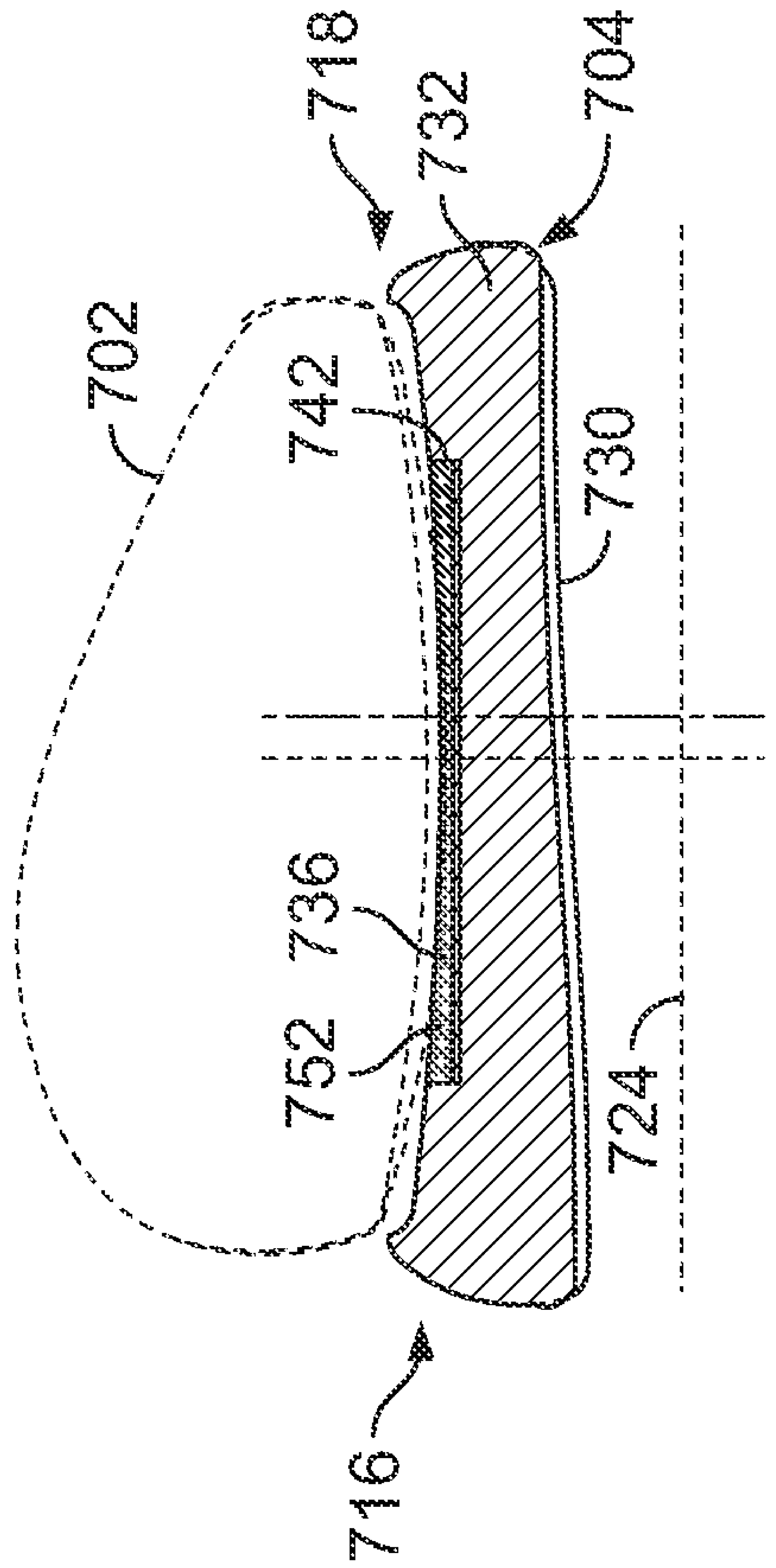

FIG. 10G

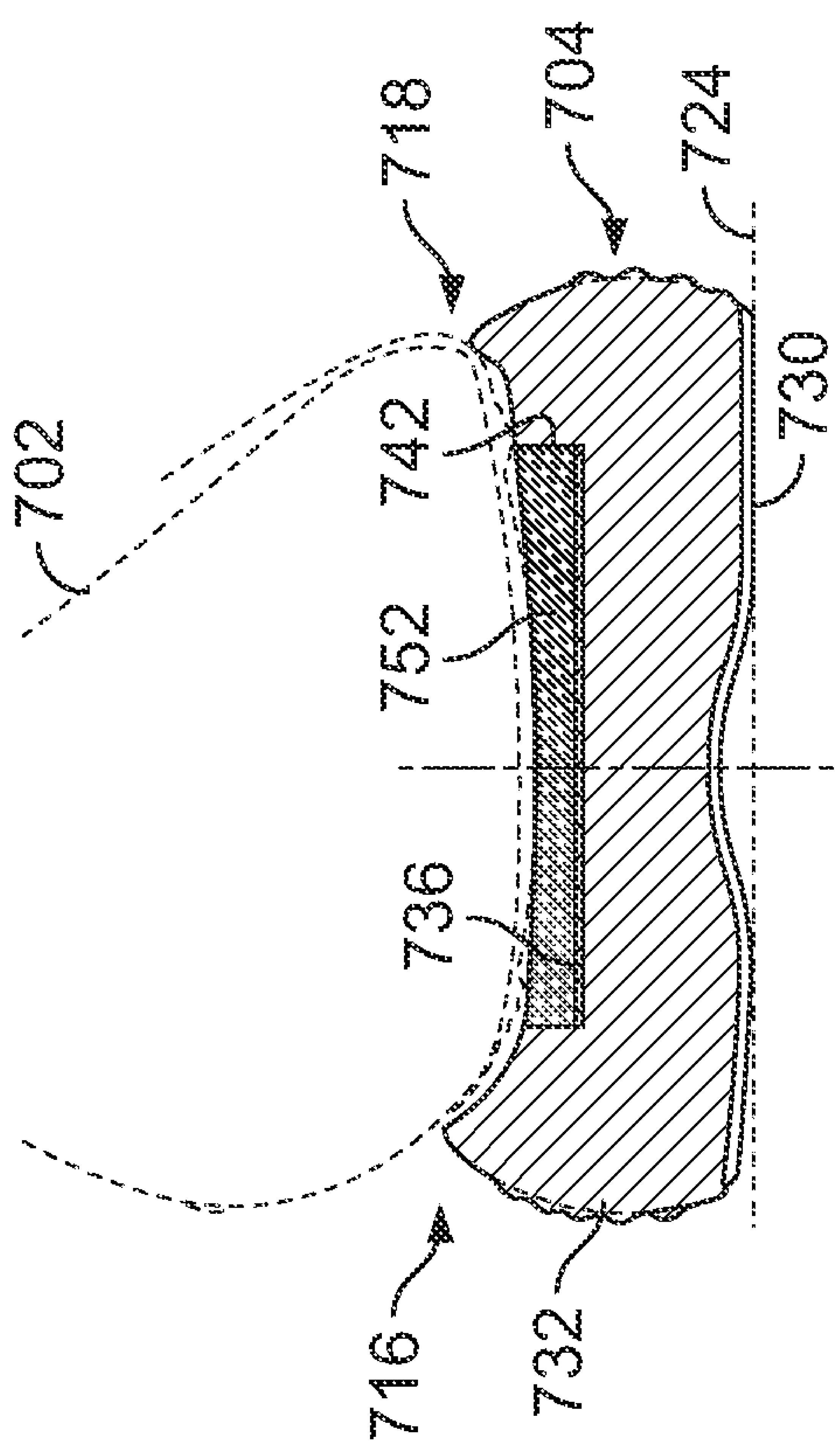

FIG. 10H

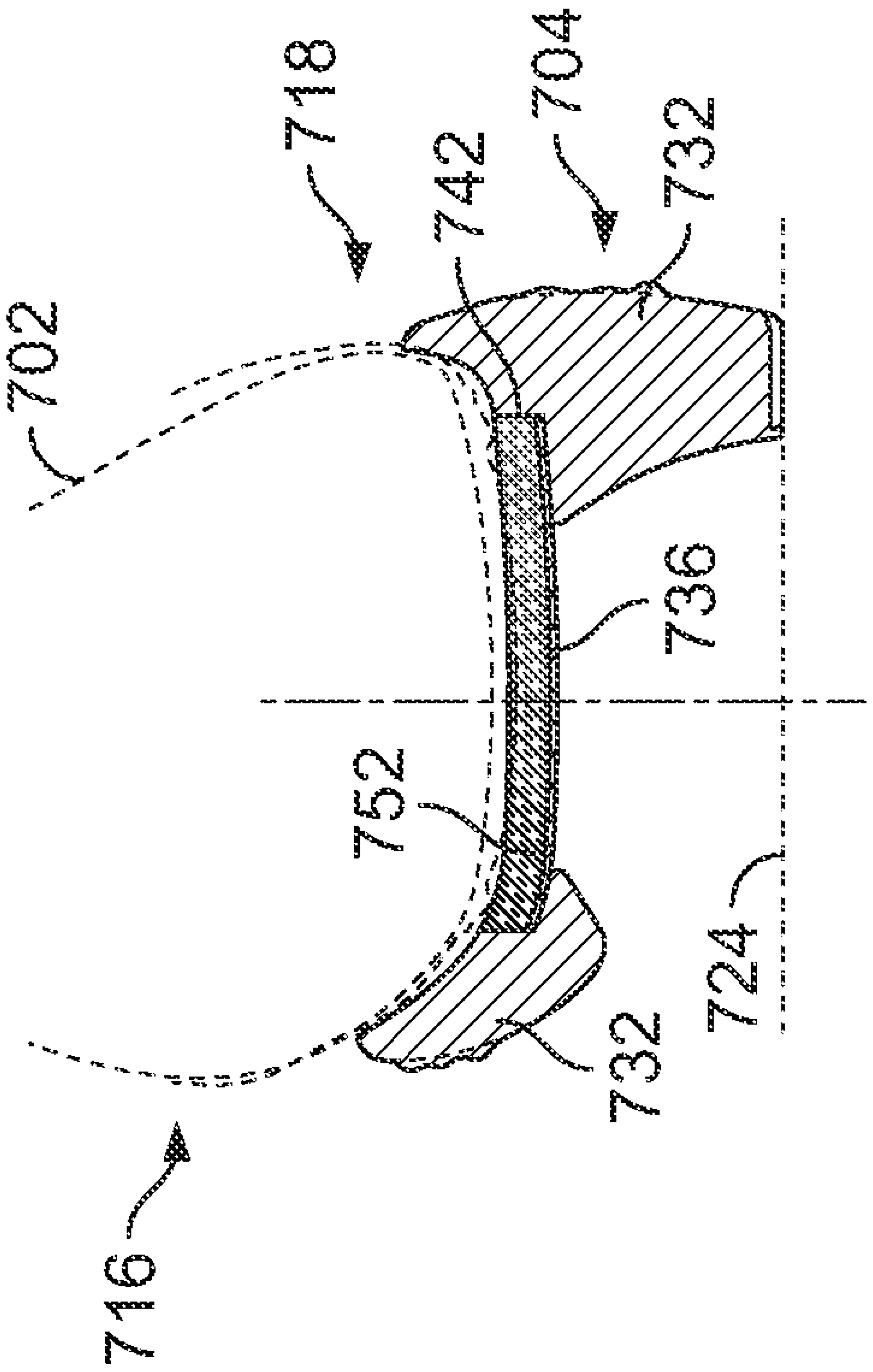

FIG. 10I

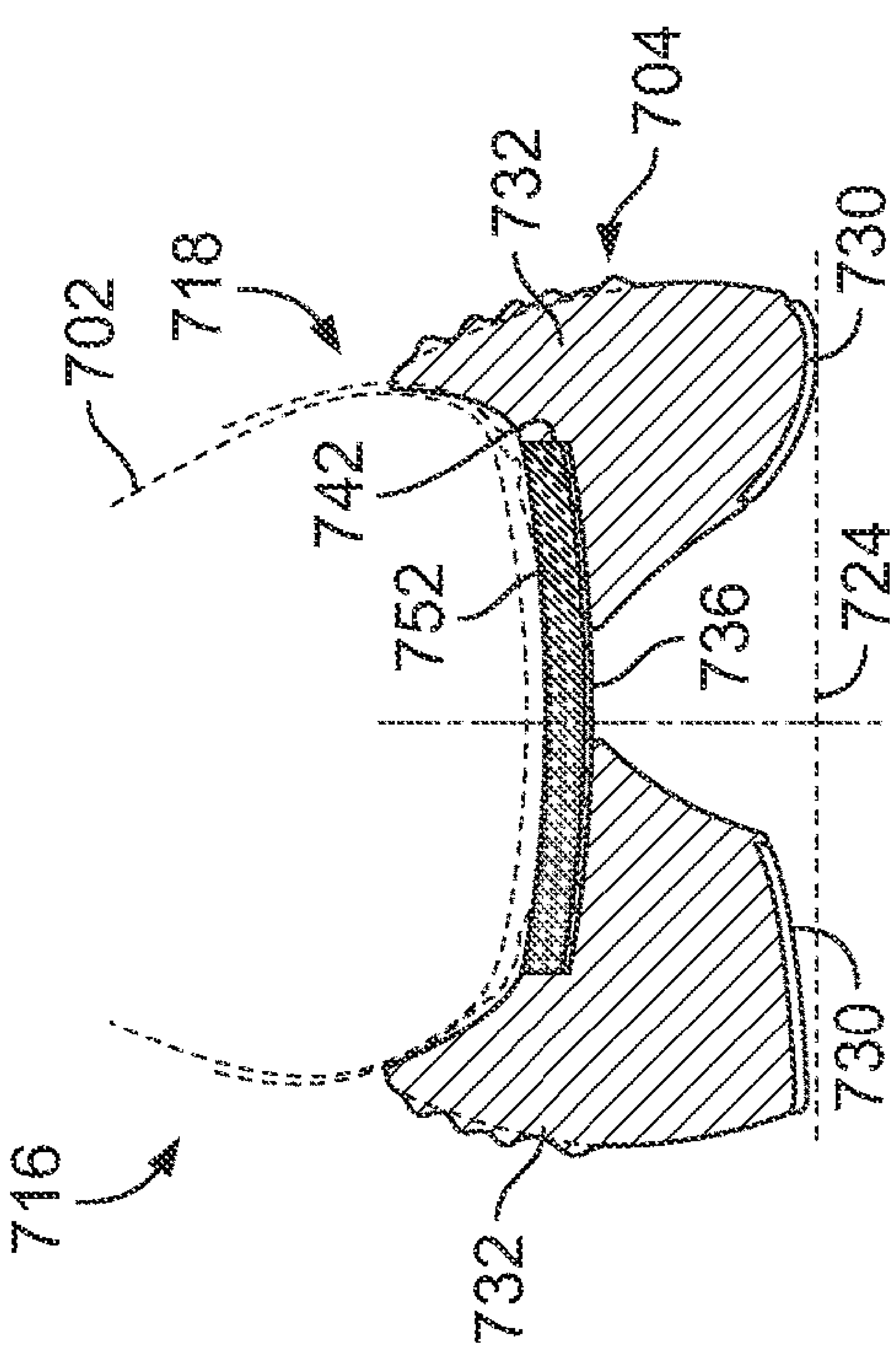

FIG. 10J

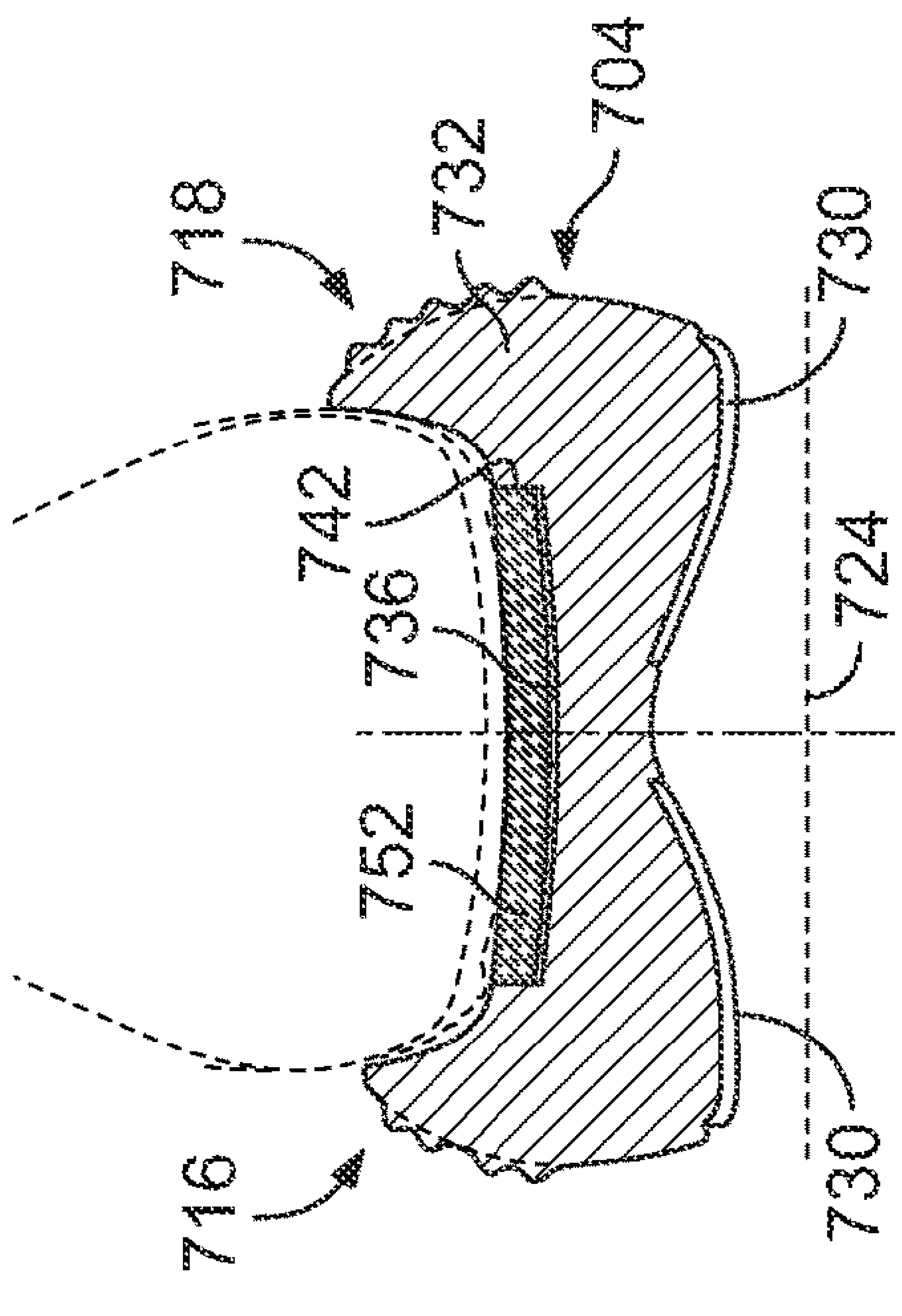

FIG. 10K

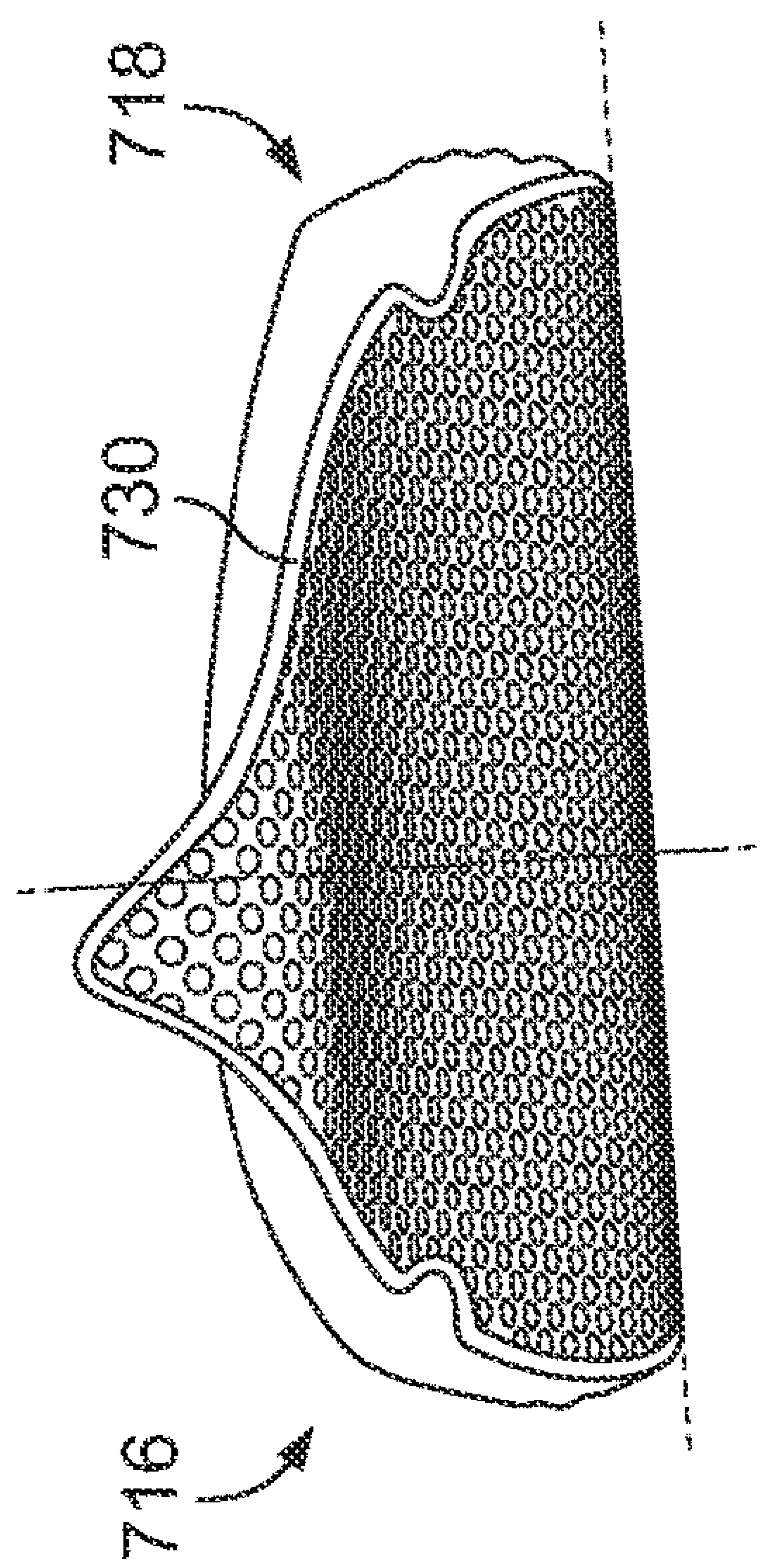

FIG. 10L

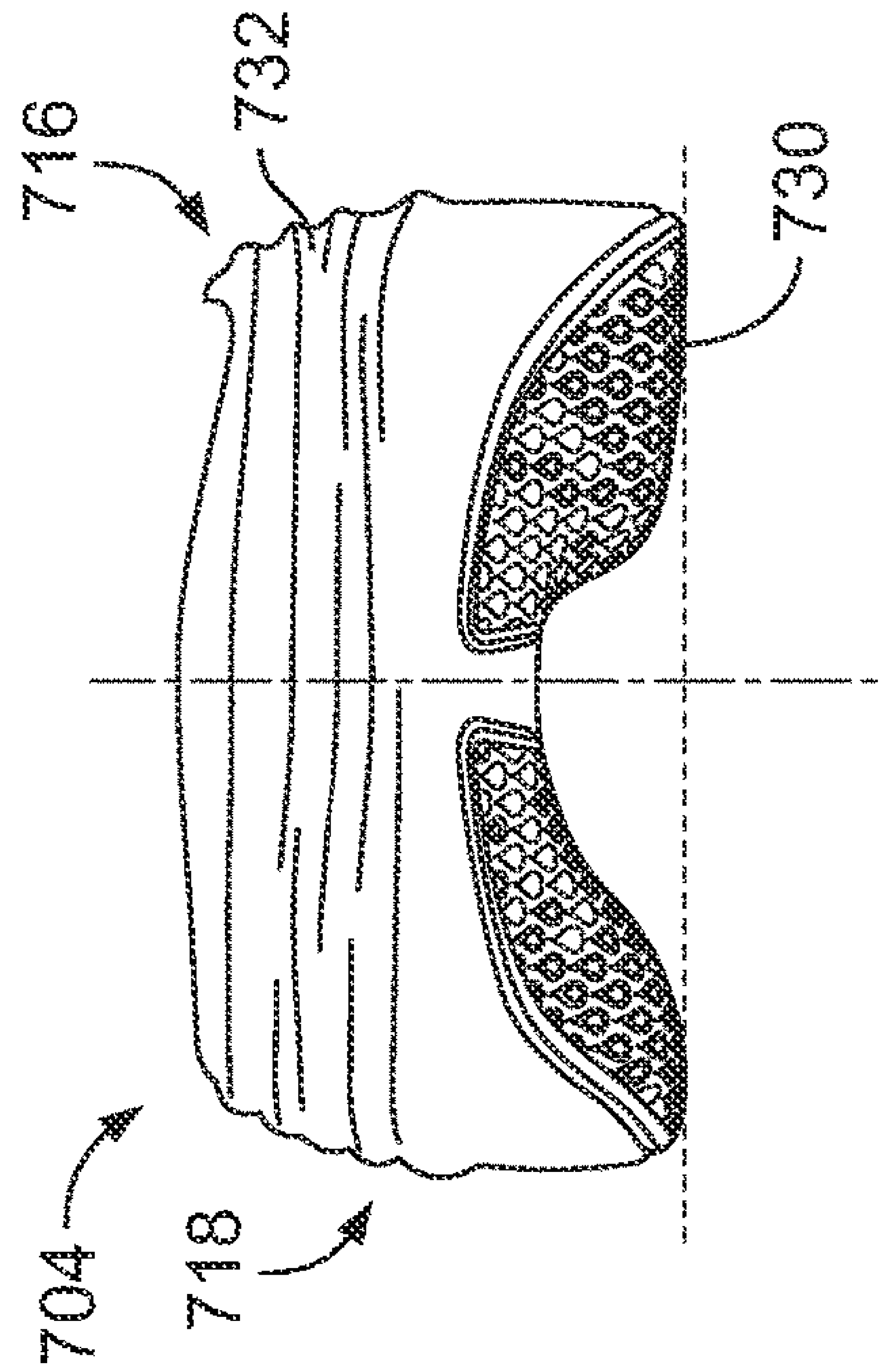

FIG. 10M

ARTICLE OF FOOTWEAR HAVING A SOLE PLATE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 18/101,992, filed Jan. 26, 2023, which is a continuation of U.S. patent application Ser. No. 17/383,954, filed Jul. 23, 2021, which claims priority to U.S. Provisional Application Ser. No. 63/055,506, filed Jul. 23, 2020, and U.S. Provisional Application Ser. No. 63/195,320, filed on Jun. 1, 2021, the contents of which are incorporated by reference herein in their entireties and are to be considered a part of this application.

REFERENCE REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

SEQUENCE LISTING

Not applicable

BACKGROUND

1. Field of the Invention

The present disclosure relates generally to an article of footwear including a sole plate.

2. Description of the Background

Many conventional shoes or other articles of footwear generally comprise an upper and a sole attached to a lower end of the upper. Conventional shoes further include an internal space, i.e., a void or cavity, which is created by interior surfaces of the upper and sole, which receives a foot of a user before securing the shoe to the foot. The sole is attached to a lower surface or boundary of the upper and is positioned between the upper and the ground. As a result, the sole typically provides stability and cushioning to the user when the shoe is being worn. In some instances, the sole may include multiple components, such as an outsole, a midsole, and an insole. The outsole may provide traction to a bottom surface of the sole, and the midsole may be attached to an inner surface of the outsole, and may provide cushioning or added stability to the sole. For example, a sole may include a particular foam material that may increase stability at one or more desired locations along the sole, or a foam material that may reduce stress or impact energy on the foot or leg when a user is running, walking, or engaged in another activity. The sole may also include additional components, such as plates, embedded with the sole to increase the overall stiffness of the sole and reduce energy loss during use.

The upper generally extends upward from the sole and defines an interior cavity that completely or partially encases a foot. In most cases, the upper extends over the instep and toe regions of the foot, and across medial and lateral sides thereof. Many articles of footwear may also include a tongue that extends across the instep region to bridge a gap between edges of medial and lateral sides of the upper, which define an opening into the cavity. The tongue may also be disposed below a lacing system and between medial and lateral sides of the upper, to allow for adjustment of shoe tightness. The

tongue may further be manipulable by a user to permit entry or exit of a foot from the internal space or cavity. In addition, the lacing system may allow a user to adjust certain dimensions of the upper or the sole, thereby allowing the upper to accommodate a wide variety of foot types having varying sizes and shapes.

The upper of many shoes may comprise a wide variety of materials, which may be utilized to form the upper and chosen for use based on one or more intended uses of the shoe. The upper may also include portions comprising varying materials specific to a particular area of the upper. For example, added stability may be desirable at a front of the upper or adjacent a heel region so as to provide a higher degree of resistance or rigidity. In contrast, other portions of a shoe may include a soft woven textile to provide an area with stretch-resistance, flexibility, air-permeability, or moisture-wicking properties.

Further, many conventional shoes or other articles of footwear, when used as a running shoe, promote an impact force at the heel region of the wearer. In particular, the impact force can be transferred from a heel of a foot, to an ankle, to a shin, to a knee, and into the hips and back of the wearer. Such impact can lead to unwanted stress on limbs when there is an instant that leg muscles are improperly tensioned and the limbs and bones are left to absorb the impact forces. The excess stress on limbs and bones can have long-term, adverse effects, such as, for example, arthrosis.

However, in many cases, articles of footwear could benefit from having uppers with an increased comfort and better fit are desired, along with soles having improved cushioning systems or structural characteristics such as a sole plate to add rigidity or spring-like properties. Additionally, articles of footwear could benefit from having a ground-engaging profile that promotes constant muscle tension to absorb and distribute impact forces are desired.

SUMMARY

An article of footwear, as described herein, may have various configurations. The article of footwear may have an upper and a sole structure connected to the upper.

According to one aspect, an article of footwear can include a sole structure and an upper. The sole structure can include an outsole having a ground engaging surface and a midsole member disposed between the outsole and the upper. The midsole can be a supercritical foam and can include a pocket that can extend from a heel region to a forefoot region. A sole plate can be disposed within the pocket and can extend from the heel region into the forefoot region. In the heel region, the sole structure can be shaped to define an entry region that can be configured to increase contact at the ground engaging surface during a heel strike. The entry region can define an angled portion that is angled at an entry angle relative to a flat ground surface.

In some embodiments, the sole structure can be shaped in the forefoot region to define an exit region that curves to angle away from the flat ground surface. The exit region can form a rocking member with a fulcrum proximate a widest portion of the sole structure. The rocking member can form a propulsion lever with the sole plate, which can be configured to propel a user forward during toe off.

In some embodiments, the sole structure can further include a cushioning layer that can be disposed between the midsole member and the upper. The cushioning layer can be positioned on top of the sole plate so that the sole plate is positioned between the midsole member and the cushioning

layer. In some cases, the sole plate can be a carbon fiber plate that can be similarly shaped to and proportionally smaller than the midsole member in at least one of the forefoot region, a midfoot region, or the heel region of the sole structure.

In some embodiments, the midsole member can define a longitudinal channel that can extend from a heel end of the sole structure and into a midfoot region. The outsole can include a first outsole member and a second outsole member that are separated from one another by the longitudinal channel so that the ground engaging surface may not be continuous across the heel region between a lateral side and medial side of the sole structure.

In some embodiments, the outsole can include a first outsole member in the forefoot region and a second outsole member in the heel region. The ground engaging surface may not continuous along a medial side of a midfoot region of the sole structure.

According to another aspect, an article of footwear can include a sole structure and an upper. The sole structure can include an outsole that can define a ground engaging surface and a midsole that can extend between the outsole and the upper. The midsole can include a first midsole member and a second midsole member, and at least one of the first midsole member or the second midsole member is a supercritical foam. The first midsole member can be coupled to the outsole and can extend from a forefoot region to a heel region of the sole structure. The first midsole member can define an entry region at a heel end in which the first midsole member is angled away from a ground surface by a first angle that is configured to increase contact at the ground engaging surface during a heel strike. The second midsole member can be coupled to the upper and can be positioned between the first midsole member and the upper. The second midsole member can extend from the heel region to the forefoot region. A sole plate can be positioned within the midsole between the first midsole member and the second midsole member.

In some embodiments, the outsole can extend at least partially into the entry region.

In some embodiments, the first midsole member can further define an exit region in the forefoot region. In the exit region, the first midsole member can curve away from the ground surface from approximately a widest portion of the sole structure to a toe end of the sole structure. In some cases, the first midsole member can define a substantially flat region between the entry region and the exit region. The first midsole member can define a rocking member between the substantially flat region and the exit region, which can create a fulcrum for the sole plate to help propel a user forward during toe off. The fulcrum can be positioned to be proximate metatarsal bones of a user.

In some embodiments, the first midsole member can define a pocket and at least one of the sole plate or the second midsole member can be disposed at least partially within the pocket. In some cases, the sole plate can be comprised of carbon fibers and extend from the heel region to the forefoot region.

According to yet another aspect, an article of footwear can include a sole structure and an upper. The sole structure can include a first midsole member and a second midsole member, and at least one of the first midsole member or the second midsole member can be a supercritical foam. The first midsole member can have a bottom surface opposite a top surface and can extend from a forefoot region to a heel region of the sole structure. The first midsole member can define an upwardly curved entry region along the bottom surface in the heel region, an upwardly curved exit region along the bottom surface in the forefoot region, and a substantially flat region extending along the bottom surface between the entry region and the exit region. At least a portion of the entry region can be angled relative to the substantially flat region to define an entry angle. The second midsole member can be positioned between the first midsole member and the upper, and can extend from the heel region to the forefoot region. A sole plate can be positioned between the first midsole member and the second midsole member. The first midsole member can define a rocking member between the substantially flat region and the exit region. The rocking member can create a fulcrum for the sole plate to help propel a user forward during toe off.

In some embodiments, the sole plate can define a first region with a first stiffness and a second region with a second stiffness. The second stiffness can be greater than the first stiffness.

In some embodiments, the sole structure can further include an outsole that can be coupled to the bottom surface of the first midsole member. The outsole can define a ground engaging surface of the sole structure and can include a first outsole portion positioned in the forefoot region and a second outsole portion positioned in the heel region. The first outsole portion and the second outsole portion can be spaced from one another so that the ground engaging surface is not continuous between the first outsole portion and the second outsole portion.

In some embodiments, the exit region can curve upwardly from approximately a widest portion of the sole structure to a toe end of the sole structure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a medial side view of an article of footwear configured as a left shoe that includes an upper and a sole structure according to an embodiment of the disclosure;

FIG. **2** is a lateral side view of the shoe of FIG. **1**;

FIG. **3** is a bottom view of the shoe of FIG. **1**;

FIG. **4** is a top plan view of the article of footwear of FIG. **1**, with an upper removed and a user's skeletal foot structure overlaid thereon;

FIG. **5**A is a medial view of a sole structure of an article of footwear that includes a sole plate according to an embodiment of the disclosure;

FIG. **5**B is a bottom view of the sole structure of FIG. **5**A;

FIG. **5**C is a lateral side view of the sole structure of FIG. **5**A;

FIG. **5**D is a cross-sectional view of the sole structure of FIG. **5**A taken along line **5**D-**5**D of FIG. **5**B;

FIG. **5**E is a top view of the sole structure of FIG. **5**A;

FIG. **5**F is a cross-sectional view of the sole structure of FIG. **5**A taken along line **5**F-**5**F of FIG. **5**B;

FIG. **5**G is a cross-sectional view of the sole structure of FIG. **5**A taken along the line **5**G-**5**G of FIG. **5**B;

FIG. **5**H is a cross-sectional view of the sole structure of FIG. **5**A taken along the line **5**H-**5**H of FIG. **5**B;

FIG. **5**I is a cross sectional view of the sole structure of FIG. **5**A taken along the line **5**I-**5**I of FIG. **5**B;

FIG. **5**J is a cross-sectional view of the sole structure of FIG. **5**A taken along the line **5**J-**5**J of FIG. **5**B;

FIG. **5**K is a cross-sectional view of the sole structure of FIG. **5**A taken along the line **5**K-**5**K of FIG. **5**B;

FIG. **5**L is a toe view of the sole structure of FIG. **5**A;

FIG. **5**M is a heel view of the sole structure of FIG. **5**A;

FIG. **6**A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. **6**B is a bottom view of the sole structure of FIG. **6**A;

FIG. **6**C is a lateral side view of the sole structure of FIG. **6**A;

FIG. **6**D is a cross-sectional view of the sole structure of FIG. **6**A taken along line **6**D-**6**D of FIG. **6**B;

FIG. **6**E is a top view of the sole structure of FIG. **6**A;

FIG. **6**F is a cross-sectional view of the sole structure of FIG. **6**A taken along line **6**F-**6**F of FIG. **6**B;

FIG. **6**G is a cross-sectional view of the sole structure of FIG. **6**A taken along the line **6**G-**6**G of FIG. **6**B;

FIG. **6**H is a cross-sectional view of the sole structure of FIG. **6**A taken along the line **6**H-**6**H of FIG. **6**B;

FIG. **6**I is a cross sectional view of the sole structure of FIG. **6**A taken along the line **6**I-**6**I of FIG. **6**B;

FIG. **6**J is a cross-sectional view of the sole structure of FIG. **6**A taken along the line **6**J-**6**J of FIG. **6**B;

FIG. **6**K is a cross-sectional view of the sole structure of FIG. **6**A taken along the line **6**K-**6**K of FIG. **6**B;

FIG. **6**L is a toe view of the sole structure of FIG. **6**A;

FIG. **6**M is a heel view of the sole structure of FIG. **6**A;

FIG. **7**A is a medial side view of a sole structure of an article of footwear that includes a sole plate according to an embodiment of the disclosure;

FIG. **7**B is a bottom view of the sole structure of FIG. **7**A;

FIG. **7**C is a lateral side view of the sole structure of FIG. **7**A;

FIG. **7**D is a cross-sectional view of the sole structure of FIG. **7**A taken along line **7**D-**7**D of FIG. **7**B;

FIG. **7**E is a top view of the sole structure of FIG. **7**A;

FIG. **7**F is a cross-sectional view of the sole structure of FIG. **7**A taken along line **7**F-**7**F of FIG. **7**B;

FIG. **7**G is a cross-sectional view of the sole structure of FIG. **7**A taken along the line **7**G-**7**G of FIG. **7**B;

FIG. **7**H is a cross-sectional view of the sole structure of FIG. **7**A taken along the line **7**H-**7**H of FIG. **7**B;

FIG. **7**I is a cross sectional view of the sole structure of FIG. **7**A taken along the line **7**I-**7**I of FIG. **7**B;

FIG. **7**J is a cross-sectional view of the sole structure of FIG. **7**A taken along the line **7**J-**7**J of FIG. **7**B;

FIG. **7**K is a cross-sectional view of the sole structure of FIG. **7**A taken along the line **7**K-**7**K of FIG. **7**B;

FIG. **7**L is a toe view of the sole structure of FIG. **7**A;

FIG. **7**M is a heel view of the sole structure of FIG. **7**A;

FIG. **8**A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. **8**B is a bottom view of the sole structure of FIG. **8**A;

FIG. **8**C is a lateral side view of the sole structure of FIG. **8**A;

FIG. **8**D is a cross-sectional view of the sole structure of FIG. **8**A taken along line **8**D-**8**D of FIG. **8**B;

FIG. **8**E is a top view of the sole structure of FIG. **8**A;

FIG. **8**F is a cross-sectional view of the sole structure of FIG. **8**A taken along line **8**F-**8**F of FIG. **8**B;

FIG. **8**G is a cross-sectional view of the sole structure of FIG. **8**A taken along the line **8**G-**8**G of FIG. **8**B;

FIG. **8**H is a cross-sectional view of the sole structure of FIG. **8**A taken along the line **8**H-**8**H of FIG. **8**B;

FIG. **8**I is a cross sectional view of the sole structure of FIG. **8**A taken along the line **8**I-**8**I of FIG. **8**B;

FIG. **8**J is a cross-sectional view of the sole structure of FIG. **8**A taken along the line **8**J-**8**J of FIG. **8**B;

FIG. **8**K is a cross-sectional view of the sole structure of FIG. **8**A taken along the line **8**K-**8**K of FIG. **8**B;

FIG. **8**L is a toe view of the sole structure of FIG. **8**A;

FIG. **8**M is a heel view of the sole structure of FIG. **8**A;

FIG. **9**A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. **9**B is a bottom view of the sole structure of FIG. **9**A;

FIG. **9**C is a lateral side view of the sole structure of FIG. **9**A;

FIG. **9**D is a cross-sectional view of the sole structure of FIG. **9**A taken along line **9**D-**9**D of FIG. **9**B;

FIG. **9**E is a top view of the sole structure of FIG. **9**A;

FIG. **9**F is a cross-sectional view of the sole structure of FIG. **9**A taken along line **9**F-**9**F of FIG. **9**B;

FIG. **9**G is a cross-sectional view of the sole structure of FIG. **9**A taken along the line **9**G-**9**G of FIG. **9**B;

FIG. **9**H is a cross-sectional view of the sole structure of FIG. **9**A taken along the line **9**H-**9**H of FIG. **9**B;

FIG. **9**I is a cross sectional view of the sole structure of FIG. **9**A taken along the line **9**I-**9**I of FIG. **9**B;

FIG. **9**J is a cross-sectional view of the sole structure of FIG. **9**A taken along the line **9**J-**9**J of FIG. **9**B;

FIG. **9**K is a cross-sectional view of the sole structure of FIG. **9**A taken along the line **9**K-**9**K of FIG. **9**B;

FIG. **9**L is a toe view of the sole structure of FIG. **9**A;

FIG. **9**M is a heel view of the sole structure of FIG. **9**A;

FIG. **10**A is a medial side view of a sole structure of an article of footwear that includes a sole plate and a foam layer according to an embodiment of the disclosure;

FIG. **10**B is a bottom view of the sole structure of FIG. **10**A;

FIG. **10**C is a lateral side view of the sole structure of FIG. **10**A;

FIG. **10**D is a cross-sectional view of the sole structure of FIG. **10**A taken along line **10**D-**10**D of FIG. **10**B;

FIG. **10**E is a top view of the sole structure of FIG. **10**A;

FIG. **10**F is a cross-sectional view of the sole structure of FIG. **10**A taken along line **10**F-**10**F of FIG. **10**B;

FIG. **10**G is a cross-sectional view of the sole structure of FIG. **10**A taken along the line **10**G-**10**G of FIG. **10**B;

FIG. **10**H is a cross-sectional view of the sole structure of FIG. **10**A taken along the line **10**H-**10**H of FIG. **10**B;

FIG. **10**I is a cross sectional view of the sole structure of FIG. **10**A taken along the line **10**I-**10**I of FIG. **10**B;

FIG. **10**J is a cross-sectional view of the sole structure of FIG. **10**A taken along the line **10**J-**10**J of FIG. **10**B;

FIG. **10**K is a cross-sectional view of the sole structure of FIG. **10**A taken along the line **10**K-**10**K of FIG. **10**B;

FIG. **10**L is a toe view of the sole structure of FIG. **10**A; and

FIG. **10**M is a heel view of the sole structure of FIG. **10**A.

DETAILED DESCRIPTION OF THE DRAWINGS

The following discussion and accompanying figures disclose various embodiments or configurations of a shoe and a sole structure. Although embodiments of a shoe or sole structure are disclosed with reference to a sports shoe, such as a running shoe, tennis shoe, basketball shoe, etc., concepts associated with embodiments of the shoe or the sole structure may be applied to a wide range of footwear and footwear styles, including cross-training shoes, football shoes, golf shoes, hiking shoes, hiking boots, ski and snowboard boots, soccer shoes and cleats, walking shoes, and track cleats, for example. Concepts of the shoe or the sole structure may also be applied to articles of footwear that are considered non-athletic, including dress shoes, sandals, loafers, slippers, and heels.

In addition to footwear, particular concepts described herein may also be applied and incorporated in other types of apparel or other athletic equipment, including helmets, padding or protective pads, shin guards, and gloves. Even further, particular concepts described herein may be incorporated in cushions, backpack straps, golf clubs, or other consumer or industrial products. Accordingly, concepts described herein may be utilized in a variety of products.

The term "about," as used herein, refers to variation in the numerical quantity that may occur, for example, through typical measuring and manufacturing procedures used for articles of footwear or other articles of manufacture that may include embodiments of the disclosure herein; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or mixtures or carry out the methods; and the like. Throughout the disclosure, the terms "about" and "approximately" refer to a range of values ±5% of the numeric value that the term precedes.

The terms "weight percent," "wt-%," "percent by weight," "% by weight," and variations thereof, as used herein, refer to the concentration of a substance or component as the weight of that substance or component divided by the total weight, for example, of the composition or of a particular component of the composition, and multiplied by 100. It is understood that, as used herein, "percent," "%," and the like may be synonymous with "weight percent" and "wt-%."

The present disclosure is directed to an article of footwear and/or specific components of the article of footwear, such as an upper and/or a sole or sole structure. The upper may comprise a knitted component, a woven textile, and/or a non-woven textile. The knitted component may be made by knitting of yarn, the woven textile by weaving of yarn, and the non-woven textile by manufacture of a unitary non-woven web. Knitted textiles include textiles formed by way of warp knitting, weft knitting, flat knitting, circular knitting, and/or other suitable knitting operations. The knit textile may have a plain knit structure, a mesh knit structure, and/or a rib knit structure, for example. Woven textiles include, but are not limited to, textiles formed by way of any of the numerous weave forms, such as plain weave, twill weave, satin weave, dobbin weave, jacquard weave, double weaves, and/or double cloth weaves, for example. Non-woven textiles include textiles made by air-laid and/or spun-laid methods, for example. The upper may comprise a variety of materials, such as a first yarn, a second yarn, and/or a third yarn, which may have varying properties or varying visual characteristics.

FIGS. **1-3** depict an embodiment of an article of footwear **100**, configured as a shoe, including an upper **102** and a sole structure **104**. The upper **102** is attached to the sole structure **104** and together define an interior cavity **106** into which a foot may be inserted. For reference, the article of footwear **100** defines a forefoot region **108**, a midfoot region **110**, and a heel region **112**. The forefoot region **108** generally corresponds with portions of the article of footwear **100** that encase portions of the foot that include the toes, the ball of the foot (shown in FIG. **4**), and joints connecting the metatarsals with the toes or phalanges (also shown in FIG. **4**). The midfoot region **110** is proximate and adjoining the forefoot region **108**, and generally corresponds with portions of the article of footwear **100** that encase the arch of a foot, along with the bridge of a foot. The heel region **112** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon.

While only a single article of footwear is depicted, i.e., a shoe that is worn on a left foot of a user, it should be appreciated that the concepts disclosed herein are applicable to a pair of shoes (not shown), which includes a left shoe and a right shoe that may be sized and shaped to receive a left foot and a right foot of a user, respectively. For ease of disclosure, a single shoe will be referenced to describe aspects of the disclosure. The disclosure below with reference to the article of footwear **100** is applicable to both a left shoe and a right shoe. However, in some embodiments there may be differences between a left shoe and a right shoe other than the left/right configuration. Further, in some embodiments, a left shoe may include one or more additional elements that a right shoe does not include, or vice versa.

Many conventional footwear uppers are formed from multiple elements (e.g., textiles, polymer foam, polymer sheets, leather, and synthetic leather) that are joined through bonding or stitching at a seam. In some embodiments, the upper **102** of the article of footwear **100** is formed from a knitted structure or knitted components. In various embodiments, a knitted component may incorporate various types of yarn that may provide different properties to an upper. For example, one area of the upper **102** may be formed from a first type of yarn that imparts a first set of properties, and another area of the upper **102** may be formed from a second type of yarn that imparts a second set of properties. Using this configuration, properties of the upper **102** may vary throughout the upper **102** by selecting specific yarns for different areas of the upper **102**. In another example, an upper mesh layer may be warp knit, while a mesh backing layer may comprise a circular knit.

The article of footwear **100** also includes a medial side **116** illustrated in FIG. **1** and a lateral side **118** illustrated in FIG. **2**. In particular, when a user is wearing the article of footwear **100**, the lateral side **118** corresponds to an outside-facing portion of the article of footwear **100** and the medial side **116** corresponds to an inside-facing portion of the article of footwear **100**. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **116** are closest to one another when a user is wearing the articles of footwear **100**, while the lateral sides **118** are defined as the sides that are farthest from one another while being worn. The medial side **116** and the lateral side **118** adjoin one another at opposing, distal ends of the article of footwear **100**.

Unless otherwise specified, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** are intended to define boundaries or areas of the article of footwear **100**. To that end, the forefoot region **108**, the midfoot region **110**, the heel region **112**, the medial side **116**, and the lateral side **118** generally characterize sections of the article of footwear **100**. Further, both the upper **102** and the sole structure **104** may be characterized as having portions within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**. Therefore, the upper **102** and the sole structure **104**, and/or individual portions of the upper **102** and the sole structure **104**, may include portions thereof that are disposed within the forefoot region **108**, the midfoot region **110**, the heel region **112**, and on the medial side **116** and the lateral side **118**.

Referring to FIG. **4**, the forefoot region **108** may generally correspond with portions of the article of footwear **100** that encase portions of a foot **10** that include the toes or phalanges **12**, the ball **14** of the foot **10**, and one or more of the

joints **16** that connect the metatarsals **18** of the foot **10** with the toes or phalanges **12**. The midfoot region **110** is proximate and adjoins the forefoot region **108**. The midfoot region **110** generally corresponds with portions of the article of footwear **100** that encase an arch **20** of a foot **10**, along with a bridge **22** of the foot **10**. The heel region **112** is proximate to the midfoot region **110** and adjoins the midfoot region **110**. The heel region **112** generally corresponds with portions of the article of footwear **100** that encase rear portions of the foot **10**, including the heel or calcaneus bone **24**, the ankle (not shown), and/or the Achilles tendon (not shown).

The sole structure **104** is connected or secured to the upper **102** and extends between a foot of a user and the ground when the article of footwear **100** is worn by the user. The sole structure **104** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system (e.g., one or more midsole members, which can be configured as cushion layers), and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **104** of the present embodiment of the invention includes one or more components that provide the sole structure **104** with preferable spring and damping properties.

The sole structure **104** includes an outsole **130**, a first midsole member **132** (e.g., a first cushion layer), a second midsole member **134** (e.g., a second cushion layer), and a sole plate **136** (see, for example FIG. **3**). The first midsole member **132**, the second midsole member **134**, and the sole plate **136** can form a cushioning system of the sole structure **104** (e.g., a midsole of the sole structure **104**). The outsole **130** may define a bottom end or surface of the sole structure **104** across the heel region **112**, the midfoot region **110**, and the forefoot region **108**. Further, the outsole **130** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **104** and may be opposite of the insole thereof. The outsole **130** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **104**. In some embodiments, the outsole **130** may be formed from rubber, for example.

Together, the first midsole member **132** and the second midsole member **134** form a midsole and may be positioned adjacent to and on top of the outsole **130** in the heel region **112** and partially in the midfoot region **110** and forefoot region **108**. The first midsole member **132** and the second midsole member **134** define a cutout portion **138**. The first midsole member **132** may be constructed from a thermoplastic material, such as polyurethane (PU) plastic, for example and the second midsole member **134** may be constructed from ethylene-vinyl acetate (EVA), copolymers thereof, or a similar type of material. In other embodiments, each of the first midsole member **132** and the second midsole member **134** may be constructed from the same material.

In other embodiments, the first midsole member **132** and/or the second midsole member **134** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first midsole member **132** and/or the second midsole member **134** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer.

The sole structure further includes the sole plate **136** disposed between the second midsole member **134** and the upper **102**. As shown in FIG. **3**, the sole plate **136** extends at least partially through the midfoot region **110** and is exposed at the cutout portion **138**. The sole plate **136** is also disposed adjacent an arched section **140** of the article of footwear **100**.

In some embodiments, the ground-engaging surface is not continuous along the medial side **116** of the midfoot region **110** of the article of footwear. For example, as illustrated in FIG. **3**, the outsole **130** partially surrounds the arched section **140**, the first midsole member **132** partially surrounds and partially defines the arched section **140**, and the second midsole member **134** surrounds and partially defines the arched section **140**.

In some embodiments, the sole plate **136** comprises a polyurethane (PU) plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers are also possible. In other embodiments, the sole plate **136** can include carbon fiber, for example. In some embodiments, these and other rigid, semi-rigid, or spring-like materials and combinations thereof may comprise the sole plate **136**. The sole plate **136** can have varied stiffness along the length of the sole plate **136**. For example, the stiffness in the forefoot region **108** of the sole plate **136** may be more or less flexible than the midfoot region **110** of the sole plate **136**, which may be more or less flexible than the heel region **112** of the sole plate **136**. Alternatively, the sole plate **136** can include a uniform stiffness. Additionally, the sole plate **136** may include additional or alternative geometries, such as, for example, notches, curves, protrusions, voids, angled edges, cutouts, etc. In some embodiments, the sole plate **136** can be configured as a shock plate to impart impact protection and facilitate leg muscle tension, thereby relieving stress on a heel, ankle, shin, knees, hips, and/or back of a user.

FIGS. **5**A through **5**M depict an exemplary embodiment of a sole structure **204** according to one embodiment of the invention. Similar to the sole structure **104**, the sole structure **204** is configured to be attached to an upper **202** and together define an interior cavity **206** of an article of footwear **200** (shown in FIG. **5**D) into which a foot may be inserted. For reference the sole structure **204** defines a forefoot region **208**, a midfoot region **210**, and a heel region **212**. The forefoot region **208** generally corresponds with portions of an article of footwear, such as the article of footwear **100**, for example, that encase portions of the foot that include the toes, the ball of the foot (shown in FIG. **4**), and joints connecting the metatarsals with the toes or phalanges (also shown in FIG. **4**). The midfoot region **210** is proximate and adjoining the forefoot region **208**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **212** is proximate and adjoining the midfoot region **110** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon (shown in FIG. **4**).

The sole structure **204** also includes a medial side **216** illustrated in FIG. **5**A and a lateral side **218** illustrated in FIG. **5**C. In particular, the lateral side **218** corresponds to an outside portion of the article of footwear and the medial side **216** corresponds to an inside portion of the article of

footwear. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **216** are closest to one another when a user is wearing the articles of footwear, while the lateral sides **218** are defined as the sides that are farthest from one another while being worn. The medial side **216** and the lateral side **218** adjoin one another at opposing, distal ends of the article of footwear.

Unless otherwise specified, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** are intended to define boundaries or areas of the article of footwear. To that end, the forefoot region **208**, the midfoot region **210**, the heel region **212**, the medial side **216**, and the lateral side **218** generally characterize sections of the article of footwear. Further, both the upper **202** and the sole structure **204** may be characterized as having portions within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**. Therefore, the upper **202** and the sole structure **204**, and/or individual portions of the upper **202** and the sole structure **204**, may include portions thereof that are disposed within the forefoot region **208**, the midfoot region **210**, the heel region **212**, and on the medial side **216** and the lateral side **218**.

The sole structure **204** is connected or secured to the upper **202** and extends between a foot of a user and the ground when the article of footwear is worn by the user. The sole structure **204** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system (e.g., one or more midsole members, which can be configured as cushioning layers), and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **204** of the present embodiment of the invention includes one or more components that provide the sole structure **204** with preferable spring and damping properties.

The sole structure **204** includes an outsole **230**, a first midsole member **232** (e.g., a first cushion layer), a second midsole member **234** (e.g., a second cushion layer), and a sole plate **236**. The first midsole member **232**, the second midsole member **234**, and the sole plate **236** can form a cushioning system of the sole structure **204** (e.g., a midsole of the sole structure **204**). The first midsole member **232** is coupled to the outsole **230** and the second midsole member **234** is positioned between the first midsole member **232** and the upper **202**. The outsole **230** may define a bottom end or surface of the sole structure **204** across the heel region **212**, the midfoot region **210**, and the forefoot region **208**. Further, the outsole **230** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **204** and may be opposite of the insole thereof. The outsole **230** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **204**. In some embodiments, the outsole **230** may be formed from rubber, for example.

When in a rested state as shown in FIGS. **5**A-**5**M, the sole structure **204** is shaped to define an entry angle **220** in the heel region **212** and an exit angle **222** in the forefoot region **208** with respect to a flat ground surface **224**. More specifically, the first midsole member **232**, the second midsole member **234**, and the outsole **230** can be shaped to define the entry angle **220** and the exit angle **222** The sole structure **204** can also define a substantially flat region **219** that is approximately parallel with the flat ground surface **224**. In some

embodiments, the entry angle **220** can be about 30 degrees. Correspondingly, the sole structure **204** can define an entry region **221** in which a bottom surface **205** (e.g., a ground-engaging surface) of the sole structure **204** curves upwardly to start angling away from the ground surface **224** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). In some embodiments, the exit angle **222** can be about 15 degrees. Correspondingly, the sole structure **204** can also define an exit region **223** in which the bottom surface **205** of the sole structure **204** curves to start angling away from the ground surface **224** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

The entry and exit angles **220**, **224** can be configured to enhance contact with a user's heel during a heel strike and promoting engagement of a large surface area of the outsole **230** in the forefoot region **208** during a push-off by the user. Accordingly, the entry region **221** can extend rearward from the substantially flat region **219** and the exit region **223** can extend forward from the substantially flat region **219**. In some embodiments, the junction between the substantially flat region **219** and the exit region **223** can be located at a widest portion **207** of the sole structure **204** (e.g., at a greatest distance between the medial and lateral sides **216**, **218**), so as to be aligned proximate to the metatarsal bones of the user.

Due to the curved nature of each of the entry region **221** and the exit region **223**, the respective junctions with the substantially flat region **219** can form rocking regions **225**, **227** (e.g., rocking members). The rocking regions **225**, **227** can create a fulcrum for the sole plate **236**. For example, the fulcrum created by the rocking region **227** can create a propulsion lever with the sole plate **236** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward.

The first midsole member **232** and the second midsole member **234** may be positioned adjacent and on top of the outsole **230** in the heel region **212** and partially in the midfoot region **210** and forefoot region **208**, with the first midsole member **232** concentrated in the areas underneath the balls and heel of a user's foot. The first midsole member **232** and the second midsole member **234** define a cutout portion **238**. The first midsole member **232** may be constructed from a thermoplastic material, such as PU, for example and the second midsole member **234** may be constructed from EVA, copolymers thereof, or a similar type of material. In other embodiments, each of the first midsole member **232** and the second midsole member **234** may be constructed from the same material. In some embodiments, the first midsole member **232** and/or the second midsole member **234** may be an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The first midsole member **232** and/or the second midsole member **234** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a polyether block amide (PEBA) copolymer, and/or an olefin block copolymer.

The sole structure further includes the sole plate **236** disposed between the second midsole member **234** and the upper **202**. As shown in FIGS. **5**D and **5**E, the sole plate **236** extends through the midfoot region **210** and is exposed at the cutout portion **238** within an arched section **240** illustrated in FIG. **5**B. Further illustrated in FIG. **5**B, the outsole **230**

partially surrounds the arched section **240**, the first midsole member **232** partially surrounds and partially comprises the arched section **240**, and the second midsole member **234** surrounds and partially comprises the arched section **240**.

In some embodiments, the ground-engaging surface is not continuous along the medial side **216** of the midfoot region **210** of the article of footwear. Correspondingly, the outsole **230** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **5**B, the outsole **230** includes a first outsole portion **230***a* positioned in the forefoot region **208** and generally forward of the widest portion **207** (e.g., to extend into the exit region **223**). Additionally, the outsole **230** includes a second outsole portion **230***b* extending from the widest portion **207**, along the lateral side **218** of the midfoot region **410**, and around a periphery of the heel region **212** to the medial side **216** (e.g., to extend into the entry region **221**).

In some embodiments, for example, as illustrated in FIGS. **5**B, and **5**I-**5**M, the first midsole member **232** can define a longitudinal channel **233** that extends from the heel region **212** and into the midfoot region **210**.

Illustrated in FIG. **5**E, the sole plate **236** extends between the heel region **212** and the forefoot region **208** and includes a plurality of cutouts **250** in the forefoot region **208**. The plurality of cutouts **250** are oriented to approximate the angle of the path of the ball of user's foot (shown in FIG. **4**) from medial side to lateral side. The plurality of cutouts **250** provide reliefs in the sole plate **250** allowing it to bend and flex more easily at the cutouts **250**. Generally, the sole plate **236** has a shape that is similar to but proportionally smaller than the midsole member **232** in the midfoot and heel regions **210**, **212**. In the forefoot region **218**, the sole plate **236** has an irregular periphery, wherein the periphery extends inward in the spaces between the cutouts **250**. Decreasing the width of the sole plate **236** in the spaces between the cutouts **250** increases the flexibility of the sole plate **236** in the forefoot region **218** by making the sole plate **236** easier to bend. Illustrated in FIGS. **5**F through **5**K, the sole plate **236** has a uniform thickness. In some embodiments, the thickness of the sole plate **236** is approximately 1.2 millimeters. In some embodiments, the sole plate **236** can be configured as a shock plate to impart impact protection and facilitate leg muscle tension thereby relieving stress on a heel, ankle, shin, knees, hips, and/or back of a user.

Continuing, FIGS. **5**F and **5**G show cross-sectional views of the forefoot region **208** of the article of footwear **200** along lines **5**F-**5**F and **5**G-**5**G in FIG. **5**B. In FIG. **5**F, the sole plate **236** is shown extending between the medial side **216** and the lateral side **218** and positioned within a pocket **242** and exposed along the top of the second midsole member **234**. In FIG. **5**G, the second midsole member **234** is shown extending through one of the plurality of cutouts **250** and contacting the upper **202**. FIG. **5**G further shows the first midsole member **232** in contact with the second midsole member **234** and the outsole **230** along the medial side **216**.

FIGS. **5**H and **5**I illustrate cross-sectional views of the midfoot region **210** of the article of footwear **200** along lines **5**H-**5**H and **5**I-**5**I of FIG. **5**B. The sole plate **236** is positioned within the pocket **242** and exposed along the top of the second midsole member **234** in FIG. **5**H. Further, the second midsole member **234** extends continuously from medial side **216** to the lateral side **218** and the first midsole member **232** is sandwiched between the second sole member **234** and the outsole **230**, with both the first midsole member **232** and the outsole **230** also extending continuously from the medial side **216** to the lateral side **218**. Looking at FIGS. **5**A, **5**C, and **5**D, and as mentioned above, this portion of the sole structure **204** is located underneath the ball of a user's foot (shown in FIG. **4**) and creates a rocking member (i.e., a rocking region) with a fulcrum proximate to the metatarsal bones of the user. The position of the sole plate **236** in relation to the first and second midsole members **232**, **234** effectively adjusts the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

Continuing, in FIG. **5**G, the sole plate **236** is also shown positioned within and exposed along the top of the second midsole member **234** but also exposed through the cutout portion **238**. The first midsole member **232** is only shown along the lateral side **218**. Along the medial side **216**, the second midsole member **234** is spaced from the ground surface **224** and is configured to be capable of engaging an elevated ground surface or other external surface at the midfoot region **210**.

Further, FIGS. **5**J and **5**K show cross-sectional views of the heel region **212** of the article of footwear **200** along lines **5**J-**5**J and **5**K-**5**K of FIG. **5**B. The sole plate **236** is positioned within the pocket **242** of the second midsole member **234** as shown in both FIGS. **5**J and **5**K, but is exposed through the cutout portion **238** in at least the area of the heel region **212** of the sole structure **204** shown in FIG. **5**J. Additionally, the first midsole member **232** is positioned between the second midsole member **234** and the outsole **230** along both the medial side **216** and the lateral side **218** of the heel region **212**. In FIG. **5**K, the sole plate **236** is shown positioned within the pocket **242** and exposed along the top of the second midsole member **234**. Further, the second midsole member **234** extends continuously from the medial side **216** to the lateral side **218**. The first midsole member **232** is positioned between the second midsole member **234** and the outsole **230**. Both the first midsole member **232** and the outsole **230** extend continuously from the medial side **216** to the lateral side **218**.

In some embodiments, the sole plate **236** comprises a PU plastic, such as a TPU material, for example. Other thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers are also possible. In other embodiments, the sole plate **236** can include carbon fiber, for example. However, these and other rigid, semi-rigid, or spring-like materials and combinations thereof may comprise the sole plate **236**. The sole plate **236** can have varied stiffness along the length of the sole plate **236**. For example, the stiffness in the forefoot region **208** of the sole plate **236** may be more or less flexible than the midfoot region **210** of the sole plate **236**, which may be more or less flexible than the heel region **212** of the sole plate **236**. Alternatively, the sole plate **236** can include a uniform stiffness. Additionally, the sole plate **236** may include additional or alternative geometries, such as, for example, notches, curves, protrusions, voids, angled edges, cutouts, etc.

FIGS. **5**L and **5**G illustrate a toe view and a heel view, respectively, of the article of footwear **200**. The outsole **230** extends up and around the second midsole member **234** and at least a portion of the upper **202** in the front of the forefoot region **208** (shown in FIGS. **5**A, **5**C and **5**D).

FIGS. **6**A through **6**M depict an exemplary embodiment of a sole structure **304** according to one embodiment of the disclosure. Similar to the sole structures **104** and **204**, the sole structure **304** is configured to be attached to an upper **302** and together define an interior cavity of an article of footwear **300** (shown in FIG. **6**D) into which a foot may be inserted. For reference the sole structure **304** defines a

forefoot region **308**, a midfoot region **310**, and a heel region **312**. The forefoot region **308** generally corresponds with portions of an article of footwear, such as the article of footwear **100**, for example, that encase portions of the foot that include the toes, the ball of the foot (shown in FIG. **4**), and joints connecting the metatarsals with the toes or phalanges (also shown in FIG. **4**). The midfoot region **310** is proximate and adjoining the forefoot region **308**, and generally corresponds with portions of the article of footwear that encase the arch of a foot, along with the bridge of a foot. The heel region **312** is proximate and adjoining the midfoot region **310** and generally corresponds with portions of the article of footwear that encase rear portions of the foot, including the heel or calcaneus bone, the ankle, and/or the Achilles tendon (shown in FIG. **4**).

The sole structure **304** also includes a medial side **316** illustrated in FIG. **6**A and a lateral side **318** illustrated in FIG. **6**C. In particular, the lateral side **318** corresponds to an outside portion of the article of footwear and the medial side **316** corresponds to an inside portion of the article of footwear. As such, left and right articles of footwear have opposing lateral and medial sides, such that the medial sides **316** are closest to one another when a user is wearing the articles of footwear, while the lateral sides **318** are defined as the sides that are farthest from one another while being worn. The medial side **316** and the lateral side **318** adjoin one another at opposing, distal ends of the article of footwear.

Unless otherwise specified, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** are intended to define boundaries or areas of the article of footwear. To that end, the forefoot region **308**, the midfoot region **310**, the heel region **312**, the medial side **316**, and the lateral side **318** generally characterize sections of the article of footwear. Further, both the upper **302** and the sole structure **304** may be characterized as having portions within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**. Therefore, the upper **302** and the sole structure **304**, and/or individual portions of the upper **302** and the sole structure **304**, may include portions thereof that are disposed within the forefoot region **308**, the midfoot region **310**, the heel region **312**, and on the medial side **316** and the lateral side **318**.

The sole structure **304** is connected or secured to the upper **302** and extends between a foot of a user and the ground when the article of footwear is worn by the user. The sole structure **304** may include one or more components, which may include an outsole, a midsole, a heel, a vamp, and/or an insole. For example, in some embodiments, a sole structure may include an outsole that provides structural integrity to the sole structure, along with providing traction for a user, a midsole that provides a cushioning system (e.g., one or more midsole members, which can be configured as cushioning layers), and an insole that provides support for an arch of a user. As will be further discussed herein, the sole structure **304** of the present embodiment of the invention includes one or more components that provide the sole structure **304** with preferable spring and damping properties.

The sole structure **304** includes an outsole **330**, a midsole member **332** (e.g., a first midsole member or cushion layer), a sole plate **336**, and a cushion layer **352** (e.g., a second midsole member or cushion layer). The midsole member **332**, the cushion layer **352**, and the sole plate **336** can form a cushioning system of the sole structure **304** (e.g., a midsole of the sole structure **304**). The outsole **330** may define a bottom end or surface of the sole structure **304** across the heel region **312**, the midfoot region **310**, and the forefoot region **308**. Further, the outsole **330** may be a ground-engaging portion or include a ground-engaging surface of the sole structure **304** and may be opposite of the insole thereof. The outsole **330** may be formed from one or more materials to impart durability, wear-resistance, abrasion resistance, or traction to the sole structure **304**. In some embodiments, the outsole **330** may be formed from rubber, for example. Similar to the outsole **230**, the outsole **330** can have an entry angle **320** in the heel region **312** and an exit angle **322** in the forefoot region **308** relative to a ground surface **324**. Further, in some embodiments, the entry angle **320** can be about 30 degrees, and in some embodiments the exit angle **322** can be about 15 degrees.

Accordingly, when in a rested state as shown in FIGS. **6**A-**6**M, the sole structure **304** is shaped to define an entry angle **320** in the heel region **312** and an exit angle **322** in the forefoot region **308** with respect to a flat ground surface **324**. The sole structure **304** can also define a substantially flat region **319** that is approximately parallel with the flat ground surface **324**. Correspondingly, the sole structure **304** can define an entry region **321** in which a bottom surface **305** (e.g., a ground-engaging surface) of the sole structure **304** curves upwardly to start angling away from the ground surface **324** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Correspondingly, the sole structure **304** can also define an exit region **323** in which the bottom surface **305** of the sole structure **304** curves upwardly to start angling away from the ground surface **324** approximate the area underneath the ball of a user's foot (shown in FIG. **4**).

The entry and exit angles **320**, **324** can be configured to enhance contact with a user's heel during a heel strike and promote engagement of a large surface area of the outsole **330** in the forefoot region **308** during a push-off by the user. Accordingly, the entry region **321** can extend rearward from the substantially flat region **319** and the exit region **323** can extend forward from the substantially flat region **319**. In some embodiments, the junction between the substantially flat region **319** and the exit region **323** can be located at a widest portion **307** of the sole structure **304** (e.g., at a greatest distance between the medial and lateral sides **316**, **318**), so as to be aligned proximate to the metatarsal bones of the user.

Due to the curved nature of each of the entry region **321** and the exit region **323**, the respective junctions with the substantially flat region **319** can form rocking regions **325**, **327** (e.g., rocking members). The rocking regions **325**, **327** can create a fulcrum for the sole plate **336**. For example, the fulcrum created by the rocking region **327** can create a propulsion lever with the sole plate **336** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward.

The midsole member **332** may be positioned adjacent and on top of the outsole **330** in the heel region **312** and partially in the midfoot region **310** and forefoot region **308**. The midsole member **332** may define a cutout portion **338**. The midsole member **332** can be constructed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. The midsole member **332** may be constructed from a thermoplastic elastomer material such as a polyether block amide (PEBA). One example of a PEBA material is PEBAX® foam. In some embodiments, the midsole member **332** can be constructed from an EVA-Solid-Sponge ("ESS") material, an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block

copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam. The midsole member **332** may be a single polymeric material or may be a blend of materials, such as an EVA copolymer, a thermoplastic polyurethane, a PEBA copolymer, and/or an olefin block copolymer.

The sole structure further includes the sole plate **336** disposed between the midsole member **332** and the upper **302**. As shown in FIGS. **6**D and **6**E, the sole plate **336** extends through the midfoot region **310** and is exposed at the cutout portion **338** within an arched section **340** illustrated in FIG. **6**B. Further illustrated in FIG. **6**B, the outsole **330** partially surrounds the arched section **340** and the midsole member **332** partially surrounds and partially comprises the arched section **340**.

In some embodiments, the ground-engaging surface is not continuous along the medial side **316** of the midfoot region **310** of the article of footwear. Correspondingly, the outsole **330** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **6**B, the outsole **330** includes a first outsole portion **330***a* positioned in the forefoot region **308** and generally forward of the widest portion **307** (e.g., to extend into the exit region **323**). Additionally, the outsole **330** includes a second outsole portion **330***b* extending from the widest portion **307**, along the lateral side **318** of the midfoot region **410**, and around a periphery of the heel region **312** to the medial side **316** (e.g., to extend into the entry region **321**).

In some embodiments, for example, as illustrated in FIGS. **6**B, and **6**I-**6**M, the first midsole member **332** can define a longitudinal channel **333** that extends from the heel region **312** and into the midfoot region **310**.

Illustrated in FIG. **6**E, the sole plate **336** extends between the heel region **312** and the forefoot region **308**. Illustrated in FIGS. **6**F through **6**K, the sole plate **336** has a uniform thickness throughout of approximately 0.8 millimeters. Generally, the sole plate **336** has a shape that is similar to but proportionally smaller than the midsole member **332** throughout the forefoot, midfoot, and heel regions **308**, **310**, **312** (shown in FIG. **6**E). In some embodiments, the sole plate **336** comprises carbon fiber, for example. In other embodiments, the sole plate **336** can include a PU plastic, such as a thermoplastic polyurethane (TPU) material, for example. Other thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers are also possible. However, these and other rigid, semi-rigid, or spring-like materials and combinations thereof may comprise the sole plate **336**. In some embodiments, the sole plate **336** can be configured as a shock plate to impart impact protection and facilitate leg muscle tension thereby relieving stress on a heel, ankle, shin, knees, hips, and/or back of a user.

The sole plate **336** can have varied stiffness along the length of the sole plate **336**. For example, the stiffness in the forefoot region **308** of the sole plate **336** may be more or less flexible than the midfoot region **310** of the sole plate **336**, which may be more or less flexible than the heel region **312** of the sole plate **336**. Alternatively, the sole plate **336** can include a uniform stiffness. Additionally, the sole plate **336** may include additional or alternative geometries, such as, for example, notches, curves, protrusions, voids, angled edges, cutouts, etc. The sole plate **336** further defines an outer periphery that would fit into a peripheral envelope of a pocket formed in the sole structure **304** (e.g., a midsole member thereof).

The cushion layer **352** extends between the heel region **312** and the midfoot region **310** as illustrated in FIG. **6**J and is positioned on top at least a portion of the sole plate **336** and between the sole plate **336** and the upper **302**. The cushion layer **352** is configured as a thin foam layer having a thickness of approximately 4 millimeters in the heel region **312** and a portion of the midfoot region **310**. In some embodiments, the cushion layer **352** can be constructed from a thermoplastic elastomer material such as a polyether block amide (PEBA). One example of a PEBA material is PEBAX® foam. In a portion of the midfoot region **310** the cushion layer **352** tapers to a thickness of zero so that there is little to no cushion layer **352** present in the forefoot region **308**. However, in some embodiments, the cushion layer **352** can extend at least partially into the forefoot region **308**.

Continuing, FIGS. **6**F and **6**G show cross-sectional views of the forefoot region **308** of the article of footwear **300** along lines **6**F-**6**F and **6**G-**6**G in FIG. **6**B. In both FIGS. **6**F and **6**G the sole plate **336** is shown positioned within a pocket **342** and exposed along the top of the midsole member **332** and in contact with the upper **302**. The sole plate **336** also extends between the medial side **316** and the lateral side **318**.

FIGS. **6**H and **6**I illustrate cross-sectional views of the midfoot region **310** along lines **6**H-**6**H and **6**I-**6**I of FIG. **6**B. In FIG. **6**H, the sole plate **336** is shown positioned within the pocket **342** in the top of the midsole member **332**. The cushion layer **352** is also positioned within the pocket **342** of the midsole member **332** and on top of the sole plate **336** (e.g., so that the sole plate **336** is embedded in the sole structure **304**, with the cushion layer **352** positioned generally above the midsole member **332**). Accordingly, the sole plate **336** is positioned between the midsole member **332** and the cushion layer **352**. Put another way, the cushion layer **352** is positioned generally above the midsole member **352** and the sole plate **336** so that the cushion layer **352** is between the upper **302** and each of the midsole member **352** and the sole plate **336**. Further, the midsole member **332** extends from the medial side **316** to the lateral side **318** and the outsole **330** extends across the bottom of the midsole member **332**. Looking at FIGS. **6**A, **6**C, and **6**D, and as mentioned above, this portion of the sole structure **304** is located underneath the ball of a user's foot (shown in FIG. **4**) and creates a rocking member (i.e., a rocking region) with a fulcrum proximate to the metatarsal bones of the user. The position of the sole plate **336** in relationship to the midsole member **332** effectively adjusts the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In FIG. **6**G, the sole plate **336** is also shown positioned within the pocket **342** of the midsole member **332** and exposed through the cutout portion **338**. The cushion layer **352** is also positioned within the pocket **342** and on top of the sole plate **336**. Along the medial side **316**, the midsole member **332** is spaced from the ground surface **324** and is configured to be capable of engaging an elevated ground surface or other external surface at the midfoot region **310**.

Further, FIGS. **6**J and **6**K show cross-sectional views of the heel region **312** along lines **6**J-**6**J and **6**K-**6**K of FIG. **6**B. In FIG. **6**J, the sole plate **336** is shown positioned within the pocket **342** of the midsole member **332** and exposed through the cutout portion **338**. The pocket **342** and the sole plate **336** are correspondingly shaped such that a peripheral envelope of the pocket **342** bounds and can be in contact with an outer

periphery of the sole plate **336**. As such, the pocket **342** can be shaped to receive the sole plate **336**, and the sole plate **336** can be shaped to be received within the pocket **336**. Additionally, the cushion layer **352** is also positioned within the pocket **342** and on top of the sole plate **336**. Accordingly, the sole plate **336** can be contained in the pocket **342** by the cushion layer **352**. Further, the midsole member **332** on the medial side **316** is spaced from the ground surface, but less spaced than in the part of the midfoot region **310** shown in FIG. **6**I. In FIG. **6**K, the sole plate **336** is shown positioned within the pocket **342** of the midsole member **332**. Additionally, the cushion layer **352** is also positioned within the pocket **342** and on top of the sole plate **336**. Further, the midsole member **332** extends continuously from the medial side **316** to the lateral side **318**.

FIGS. **6**L and **6**G illustrate a toe view and a heel view, respectively, of the article of footwear **300**. The outsole **330** extends up and around the midsole member **332** and at least a portion of the upper **302** in the front of the forefoot region **308** (shown in FIGS. **6**A, **6**C and **6**D).

FIGS. **7**A through **7**M illustrate another embodiment of an article of footwear **400** according to the invention. In many aspects, the article of footwear **400** is similar to the article of footwear **200** described above and similar numbering in the **400** series is used for the article of footwear **400**. For example, the article of footwear **400** has an upper **402**, a sole structure **404**, an interior cavity **406** defined by the combination of the upper **402** and the sole structure **404**, a forefoot region **408**, a midfoot region **410**, a heel region **412**, a medial side **416**, and a lateral side **418**. Further, the sole structure **404** has an outsole **430**, a first midsole member **432** (e.g., a first cushion layer), a second midsole member **434** (e.g., a second cushion layer) with a pocket **442**, a sole plate **436**, an arched section **440**, and a cutout portion **438**. The first midsole member **432**, the second midsole member **434**, and the sole plate **436** can form a cushioning system of the sole structure **404** (e.g., a midsole of the sole structure **404**). Additionally, the sole structure **404** is shaped to define an entry angle **420** in the heel region **412** and an exit angle **422** in the forefoot region **408** with respect to a flat ground surface **424**. Similarly, in some embodiments, the entry angle **420** can be about 30 degrees and the sole structure **404** can start angling away from the ground surface **424** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **422** can be about 15 degrees and can start angling away from the ground surface **424** approximate the area underneath the balls of a user's foot (shown in FIG. **4**). As illustrated in FIG. **7**B, the sole plate **436** comprises an insignia **490** that is visible through the cutout portion **438**.

Additionally, the first midsole member **432**, the second midsole member **434**, and the sole plate **436** can be similarly constructed as the first midsole member **232**, the second midsole member **234**, and the sole plate **236**. For example, the first and second midsole members **432**, **434** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, ethylene-vinyl acetate (EVA) polymer, copolymers thereof, or a similar type of material and the sole plate **436** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof.

In some aspects, however, the articles of footwear **200**, **400** differ from each other. For example, the sole plate **436** has a shape that is similar to but proportionally smaller than the midsole member **432** throughout the forefoot, midfoot, and heel regions **408**, **410**, **412** (shown in FIG. **7**E).

Additionally, as shown in FIG. **7**D and FIGS. **7**G, **7**I, and **7**J, which are cross-sectional views taken along lines **7**G-**7**G, **7**I-**7**I, and **7**J-**7**J in FIG. **7**B within the forefoot region **408**, the midfoot region **410**, and the heel region **412**, respectively, the first midsole member **432** and the second midsole member **434** are positioned differently within the sole structure **404** than the first midsole member **232** and the second midsole member **234** in the sole structure **204**. For example, the second midsole member **434** extends around the front of the first midsole member **432** in the forefoot region **408** (shown in FIG. **7**D).

FIGS. **8**A through **8**M illustrate another embodiment of an article of footwear **500** according to the invention. In many aspects, the article of footwear **500** is similar to the article of footwear **300** described above and similar numbering in the **500** series is used for the article of footwear **500**. For example, the article of footwear **500** has an upper **502**, a sole structure **504**, an interior cavity **506** defined by the combination of the upper **502** and the sole structure **504**, a forefoot region **508**, a midfoot region **510**, a heel region **512**, a medial side **516**, and a lateral side **518**. Further, the sole structure **504** has an outsole **530**, a midsole member **532** (i.e., a first midsole member or cushion layer of a midsole) with a pocket **542**, a sole plate **536**, a cushion layer **552** (i.e., a second midsole member or cushion layer of a midsole), an arched section **540**, and a cutout portion **538**. The sole plate **536** is disposed between the midsole member **532** and the cushion layer **552** and the cushion layer **552** is positioned between the upper **502** and each of the midsole member **532** and the sole plate **536**. The midsole member **532**, the cushion layer **552**, and the sole plate **536** can form a cushioning system of the sole structure **504** (e.g., a midsole of the sole structure **504**). Additionally, the sole structure **504** is shaped to define an entry angle **520** in the heel region **512** and an exit angle **522** in the forefoot region **508** with respect to a flat ground surface **524**. Similarly, in some embodiments, the entry angle **520** can be about 30 degrees and the sole structure **504** can start angling away from the ground surface **524** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **522** can be about 15 degrees and can start angling away from the ground surface **524** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Accordingly, when in a rested state as shown in FIGS. **8**A-**8**M, the sole structure **504** is shaped to define an entry angle **520** in the heel region **512** and an exit angle **522** in the forefoot region **508** with respect to a flat ground surface **524**. The sole structure **504** can also define a substantially flat region **519** that is approximately parallel with the flat ground surface **524**. The substantially flat region **519** can extend from a first end **560** to a second end **562**. As illustrated in FIGS. **8**A, **8**C, and **8**D, the first end **560** can be in the heel region **512** and the second end **562** can be in the forefoot region **508**.

Correspondingly, the sole structure **504** can define an entry region **521** in which a bottom surface **505** (e.g., a ground engaging surface) of the sole structure **504** curves upwardly to start angling away from the ground surface **524** approximate the area underneath the heel of a user's foot (shown in FIG. **4**) by at least the entry angle **520**. In that regard, the entry region **521** can include an angled portion **557** (e.g., an angled region). The angled portion **557** extends from a first end **564** to a second end **566**. The first end **564** is positioned proximate the substantially flat region **519** such

that the first end **564** is positioned below a heel end **568** of the sole plate **536** and such that the first end **564** is closer to the forefoot region **508** than is the heel end **568** of the sole plate **536**. The second end **566** is positioned above the heel end **568** of the sole plate **536** and the second end **566** is positioned farther from the forefoot region **508** than is the heel end **568** of the sole plate **536**. The angled portion **557** is substantially flat between the first end **564** and the second end **566**. For example, between the first end **564** and the second end **566**, the angled portion **557**, and thus the entry region **521**, can be at about the entry angle **520** to enhance contact with a user's heel during a heel strike. In that regard, the angled portion **557** forms a portion of the bottom surface **505** of the sole structure **504** that is configured to engage the ground during a heel strike. In some cases, the second end **566** of the angled portion **557**, and thus the entry region **521**, defines a heel end **570** of the bottom surface **505**. Accordingly, the ground-engaging bottom surface **505** extends above the heel end **570** of the sole plate **536**.

Correspondingly, the sole structure **504** can also define an exit region **523** in which the bottom surface **505** of the sole structure **504** curves upwardly to start angling away from the ground surface **524** approximate the area underneath the balls of a user's foot (shown in FIG. **4**) by at least the exit angle **522**. In that regard, the exit region **523** can include an angled portion **559** (e.g., an angled region). The angled portion **559** extends from a first end **574** to a second end **576**. The first end **574** is positioned proximate the substantially flat region **519** such that the first end **574** is positioned below a toe end **578** of the sole plate **536** and such that the first end **574** is closer to the heel region **512** than is the toe end **578** of the sole plate **536**. The angled portion **559** is substantially flat between the first end **574** and the second end **576**. For example, between the first end **574** and the second end **576** the angled portion **559**, and thus the exit region **523**, can be at about the exit angle **522** to adjust the running posture of the user to be a forward tilt to move the running motion of the user toward their forefoot to propel the use forward. In that regard the angled portion **559** forms a portion of the bottom surface **505** of the sole structure **504** that is configured to engage the ground during toe-off. In some cases, the second end **576** of the angled portion **559**, and thus the exit region **523**, defines a toe end **580** of the bottom surface **505**.

The entry and exit angles **520**, **522** can be configured to enhance contact with a user's heel during a heel strike and promoting engagement of a large surface area of the outsole **530** in the forefoot region **508** during a push-off by the user. Accordingly, the entry region **521** can extend rearward from the substantially flat region **519** and the exit region **523** can extend forward from the substantially flat region **519**. In some embodiments, the junction between the substantially flat region **519** and the exit region **523** can be located at a widest portion **507** of the sole structure **504** (e.g., at a greatest distance between the medial and lateral sides **516**, **518**), so as to be aligned proximate to the metatarsal bones of the user. As illustrated in FIGS. **8**C and **8**D, the entry region **521** is configured to form a gap **590** between the midsole **532** and the flat ground surface **524**. The flat ground surface **524** corresponds with a resting plane **592** upon which the article of footwear is configured to rest when set on the flat ground surface **524**. In this case, the resting plane **592** is defined by the substantially flat region **519**. The heel end **568** of the sole plate **536** is positioned over the gap **590**. At the heel end **568** of the sole plate **536**, the gap **590** has a thickness (T**1**) that is greater than a thickness (T**2**) of the outsole **530**. As noted herein, the thickness (T**1**) of the gap **590** and the thickness (T**2**) of the outsole **530** are taken in a direction that is normal to the resting plane **592**. As illustrated in FIG. **8**B, the cutout portion **538** defines a cutout length (CL**1**) at a longest portion of the cutout portion **538**. The cutout length (CL**1**) extends in a heel-toe direction and parallel with respect to the flat ground surface **524** when the sole structure **504** is resting on the flat ground surface **524**. The cutout portion **538** also defines a cutout width (CW**1**) at a widest portion of the cutout portion **538**. The cutout width (CW**1**) extends in a medial-lateral direction and parallel with respect to the flat ground surface **524** when the sole structure **504** is resting on the flat ground surface **524**. The cutout length (CL**1**) is greater than the cutout width (CW**1**).

Due to the curved nature of each of the entry region **521** and the exit region **523**, the respective junctions with the substantially flat region **519** can form rocking regions **525**, **527** (e.g., rocking members). The rocking regions **525**, **527** are formed as convex regions of the bottom surface **505** that can create a fulcrum for the sole plate **536**. For example, the fulcrum created by the rocking region **525** can create a propulsion lever with the sole plate **536** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward. More specifically, the fulcrum created by the rocking region **525** can create a propulsion lever with the sole plate **536** between the entry region **521** and the substantially flat region **519**. The rocking region **525** is an entirely convex region that extends between the first end **560** of the substantially flat region **519** and the first end **564** of the substantially flat angled portion **557**. The entry region **521** includes the rocking region **525** and the angled portion **557**, such that the entry region **521** curves upwardly from the substantially flat region **519** at the rocking region **525** to form the angled portion **557**. In that regard, the rocking region **525** forms an upwardly curved portion (e.g., an upwardly curved entry region). The fulcrum created by the rocking region **527** can also act as a propulsion level with the sole plate **536** proximate to the metatarsal bones of the user by adjusting the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot. The fulcrum created by the rocking region **527** can create a propulsion lever with the sole plate **536** between the exit region **523** and the substantially flat region **519**. The rocking region **527** is an entirely convex region that extends between the second end **562** of the substantially flat region **519** and the first end **574** of the substantially flat angled portion **559**. The exit region **523** includes the rocking region **527** and the angled portion **559**, such that the exit region **523** curves upwardly from the substantially flat region **519** at the rocking region **527** to form the angled portion **559**. In that regard, the rocking region **527** forms an upwardly curved portion (e.g., an upwardly curved exit region).

Additionally, the midsole member **532**, the sole plate **536**, and the cushion layer **552** can be similarly constructed as the midsole member **332**, the sole plate **336**, and the cushion layer **352**. For example, the midsole member **532** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material; the sole plate **536** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof; and the cushion layer **552** can be formed from a thermoplastic elastomer material, for example, a polyether block amide (PEBA), including PEBAX® foam. In some embodiments, the cushion layer member **552** can be constructed from an EVA-Solid-Sponge ("ESS") material,

an EVA foam (e.g., PUMA® ProFoam Lite™, IGNITE Foam), polyurethane, polyether, an olefin block copolymer, a thermoplastic material (e.g., a thermoplastic polyurethane, a thermoplastic elastomer, a thermoplastic polyolefin, etc.), or a supercritical foam.

Another similarity is that the sole plate **536** has a shape that is similar to but proportionally smaller than the midsole member **532** throughout the forefoot, midfoot, and heel regions **508**, **510**, **512** (shown in FIG. **8**E). Additionally, the pocket **542** and the sole plate **536** are correspondingly shaped such that a peripheral envelope of the pocket **542** bounds and can be in contact with an outer periphery of the sole plate **536**. Put another way, the pocket **542** can be shaped to receive the sole plate **536**, and the sole plate **536** can be shaped to be received in the pocket **542**. Further, the cushion layer **552** can also be positioned within the pocket **542**, such that the sole plate **536** can be secured in the pocket **542** by the cushion layer **352**. In particular, the sole plate **536** can be secured between the midsole member **532** and the cushion layer **552**, with the midsole member **532** in contact with a first side of the sole plate **536** and the cushion layer **552** in contact with a second side of the sole plate **536** that is opposite the first side. It is appreciated that the cushioning layer **552** can be coupled to the midsole member **532**. Moreover, the position of the sole plate **536** in relation to the first midsole member **532** and the cushion layer **552** can effectively adjust the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In some aspects, however, the articles of footwear **300**, **500** differ from each other. For example, the cushion layer is different. As shown in FIGS. **8**D and **8**G, which is a cross-sectional view taken along line **8**G-**8**G in FIG. **8**B within the forefoot region **508**, the cushion layer **552** extends into the forefoot region **508**.

Further, in some embodiments, the ground-engaging surface is not continuous along the medial side **516** of the midfoot region **510** of the article of footwear. Correspondingly, the outsole **530** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **8**B, the outsole **530** includes a first outsole portion **530***a* positioned in the forefoot region **508** and generally forward of the widest portion **507** (e.g., to extend into the exit region **523**). Additionally, the outsole **530** includes a second outsole portion **530***b* extending from the widest portion **507** and along the lateral side **518** of the midfoot region **410** to the heel region **512**. Further, the outsole **530** can include a third outsole portion **530***c* that is coupled to the medial side **516** of the first midsole member in the heel region **512** (e.g., to extend into the entry region **521**).

In some embodiments, for example, as illustrated in FIGS. **8**B, and **8**I-**8**M, the first midsole member **532** can define a longitudinal channel **533** that extends from the heel region **512** and into the midfoot region **510**. As illustrated, the second and third outsole portions **530***b*, **530***c* are positioned on opposite sides of the longitudinal channel **533** so that the ground engaging surface is not continuous between the medial and lateral sides **516**, **518** in the heel region **512**.

FIGS. **9**A through **9**M illustrate another embodiment of an article of footwear **600** according to the invention. In many aspects, the article of footwear **600** is similar to the article of footwear **500** described above and similar numbering in the **600** series is used for the article of footwear **600**. For example, the article of footwear **600** has an upper **602**, a sole structure **604**, an interior cavity **606** defined by the combination of the upper **602** and the sole structure **604**, a forefoot region **608**, a midfoot region **610**, a heel region **612**, a medial side **616**, and a lateral side **618**. Further, the sole structure **604** has an outsole **630**, a midsole member **632** (e.g., a first midsole member or cushion layer of a midsole) with a pocket **642**, a sole plate **636**, a cushion layer **652** (e.g., a second midsole member or cushion layer of a midsole), an arched section **640**, and a cutout portion **638**. The sole plate **636** is disposed between the midsole member **632** and the cushion layer **652**. The cushion layer **652** is positioned between the upper **602** and each of the midsole member **632** and the sole plate **636**. The midsole member **632**, the cushion layer **652**, and the sole plate **636** can form a cushioning system of the sole structure **604** (e.g., a midsole of the sole structure **604**). Additionally, the sole structure **604** is shaped to define an entry angle **620** in the heel region **612** and an exit angle **622** in the forefoot region **608** with respect to a flat ground surface **624**. Similarly, in some embodiments, the entry angle **620** can be about 30 degrees and the sole structure **604** can start angling away from the ground surface **624** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **622** can be about 15 degrees and can start angling away from the ground surface **624** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Accordingly, when in a rested state as shown in FIGS. **9**A-**9**M, the sole structure **604** is shaped to define an entry angle **620** in the heel region **612** and an exit angle **622** in the forefoot region **608** with respect to a flat ground surface **624**. The sole structure **604** can also define a substantially flat region **619** that is approximately parallel with the flat ground surface **624**. The substantially flat region **619** can extend from a first end **660** to a second end **662**. As illustrated in FIGS. **8**A, **8**C, and **8**D, the first end **660** can be in the heel region **612** and the second end **662** can be in the forefoot region **608**.

Correspondingly, the sole structure **604** can define an entry region **621** in which a bottom surface **605** (e.g., a ground engaging surface) of the sole structure **604** curves upwardly to start angling away from the ground surface **624** approximate the area underneath the heel of a user's foot (shown in FIG. **4**) by at least the entry angle **620**. In that regard, the entry region **621** can include an angled portion **567** (e.g., an angled region). The angled portion **657** extends from a first end **664** to a second end **666**. The first end **664** is positioned proximate the substantially flat region **619** such that the first end **664** is positioned below a heel end **668** of the sole plate **636** and such that the first end **664** is closer to the forefoot region **608** than is the heel end **668** of the sole plate **636**. The second end **666** is positioned above the heel end **668** of the sole plate **636** and the second end **666** is positioned farther from the forefoot region **608** than is the heel end **668** of the sole plate **636**. The angled portion **657** is substantially flat between the first end **664** and the second end **666**. For example, between the first end **664** and the second end **666**, the angled portion **657**, and thus the entry region **621**, can be at about the entry angle **620** to enhance contact with a user's heel during a heel strike. In that regard, the angled portion **657** forms a portion of the bottom surface **605** of the sole structure **604** that is configured to engage the ground during a heel strike. In some cases, the second end **666** of the angled portion **657**, and thus the entry region **621**, defines a heel end **670** of the bottom surface **605**. Accordingly, the ground-engaging bottom surface **605** extends above the heel end **670** of the sole plate **636**.

Correspondingly, the sole structure **604** can also define an exit region **623** in which the bottom surface **605** of the sole structure **604** curves upwardly to start angling away from the ground surface **624** approximate the area underneath the balls of a user's foot (shown in FIG. **4**) by at least the exit angle **622**. In that regard, the exit region **623** can include an angled portion **659** (e.g., an angled region). The angled portion **659** extends from a first end **674** to a second end **676**. The first end **674** is positioned proximate the substantially flat region **619** such that the first end **674** is positioned below a toe end **678** of the sole plate **636** and such that the first end **674** is closer to the heel region **612** than is the toe end **678** of the sole plate **636**. The second end **676** is positioned above the toe end **678** of the sole plate **636** and the second end **676** is positioned farther from the heel region **612** than is the toe end **678** of the sole plate **636**. The angled portion **659** is substantially flat between the first end **674** and the second end **676**. For example, between the first end **674** and the second end **676**, the angled portion **659**, and thus the exit region **623**, can be at about the exit angle **622** to adjust the running posture of the user to be a forward tilt to move the running motion of the user toward their forefoot to propel the use forward. In that regard the angled portion **659** forms a portion of the bottom surface **605** of the sole structure **604** that is configured to engage the ground during toe-off. In some cases, the second end **676** of the angled portion **659**, and thus the exit region **623**, defines a toe end **680** of the bottom surface **605**.

The entry and exit angles **620**, **622** can be configured to enhance contact with a user's heel during a heel strike and promoting engagement of a large surface area of the outsole **630** in the forefoot region **608** during a push-off by the user. Accordingly, the entry region **621** can extend rearward from the substantially flat region **619** and the exit region **623** can extend forward from the substantially flat region **619**. In some embodiments, the junction between the substantially flat region **619** and the exit region **623** can be located at a widest portion **607** of the sole structure **604** (e.g., at a greatest distance between the medial and lateral sides **616**, **618**), so as to be aligned proximate to the metatarsal bones of the user. As illustrated in FIGS. **9**C and **9**D, the entry region **621** is configured to form a gap **690** between the midsole **632** and the flat ground surface **624**. The flat ground surface **624** corresponds with a resting plane **692** upon which the article of footwear is configured to rest when set on the flat ground surface **624**. In this case, the resting plane **692** is defined by the substantially flat region **619**. The heel end **668** of the sole plate **636** is positioned over the gap **690**. At the heel end **668** of the sole plate, the gap **690** has a thickness (T**3**) that is greater than a thickness (T**4**) of the outsole **630**. As noted herein, the thickness (T**3**) of the gap **690** and the thickness (T**4**) of the outsole **630** are taken in a direction that is normal to the resting plane **692**. As illustrated in FIG. **9**B, the cutout portion **638** defines a cutout length (CL**2**) at a longest portion of the cutout portion **638**. The cutout length (CL**2**) extends in a heel-toe direction and parallel with respect to the flat ground surface **624** when the sole structure **604** is resting on the flat ground surface **624**. The cutout portion **638** also defines a cutout width (CW**2**) at a widest portion of the cutout portion **638**. The cutout width (CW**2**) extends in a medial-lateral direction and parallel with respect to the flat ground surface **624** when the sole structure **604** is resting on the flat ground surface **624**. The cutout length (CL**2**) is greater than the cutout width (CW**2**). As illustrated in FIGS. **9**C and **9**D, the midsole member **632** comprises an external groove **694** defined in the heel region **612**. As illustrated in FIG. **9**D, the external groove **694** at a heel end **696** of the sole structure **604** is positioned above the second end **666** of the angled portion **657** and is positioned entirely above the sole plate **636**. Further, as illustrated in FIG. **9**D, the external groove **694** is positioned above a portion of the upper **602**. As illustrated in FIGS. **9**A and **9**C, a portion of the medial side **616** of the sole structure **604** and a portion of the lateral side **618** of the sole structure **604** each comprise a plurality of undulating surfaces **698**.

Due to the curved nature of each of the entry region **621** and the exit region **623**, the respective junctions with the substantially flat region **619** can form rocking regions **625**, **627** (e.g., rocking members). The rocking regions **625**, **627** are formed as convex regions of the bottom surface **505** that can create a fulcrum for the sole plate **636**. For example, the fulcrum formed by the rocking region **625** can create a propulsion lever with the sole plate **636** between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward. More specifically, the fulcrum created by the rocking region **625** can create a propulsion lever with the sole plate **636** between the entry region **621** and the substantially flat region **619**. The rocking region **625** is an entirely convex region that extends between the first end **660** of the substantially flat region **619** and the first end **664** of the substantially flat angled portion **657**. The entry region **621** includes the rocking region **625** and the angled portion **657**, such that the entry region **621** curves upwardly from the substantially flat region **619** at the rocking region **625** to form the angled portion **657**. In that regard, the rocking region **625** forms an upwardly curved portion (e.g., an upwardly curved entry region). The fulcrum formed by the rocking region **627** can also act as a propulsion level with the sole plate **636** proximate to the metatarsal bones of the user by adjusting the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot. The fulcrum created by the rocking region **627** can create a propulsion lever with the sole plate **636** between the exit region **623** and the substantially flat region **619** (e.g., proximate the widest portion **607** of the sole structure **604**). The rocking region **627** is an entirely convex region that extends between the second end **662** of the substantially flat region **619** and the first end **674** of the substantially flat angled portion **659**. The exit region **623** includes the rocking region **627** and the angled portion **659**, such that the exit region **623** curves upwardly from the substantially flat region **619** at the rocking region **627** to form the angled portion **659**. In that regard, the rocking region **627** forms an upwardly curved portion (e.g., an upwardly curved exit region).

Additionally, the midsole member **632**, the sole plate **636**, and the cushion layer **652** can be similarly constructed as the midsole member **532**, the sole plate **536**, and the cushion layer **552**. For example, the midsole member **632** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material; the sole plate **636** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof; and the cushion layer **652** can be formed from a thermoplastic elastomer material, for example, a polyether block amide (PEBA), including PEBAX® foam.

Further, the sole plate **636** has a shape that is similar to but proportionally smaller than the midsole member **632** throughout the forefoot, midfoot, and heel regions **608**, **610**, **612** (shown in FIG. **9**E). Additionally, the pocket **642** and

the sole plate **636** are correspondingly shaped such that a peripheral envelope of the pocket **642** bounds and can be in contact with an outer periphery of the sole plate **636**. Put another way, the pocket **642** can be shaped to receive the sole plate **636**, and the sole plate **636** can be shaped to be received within the pocket **642**. Further, the cushion layer **652** can also be positioned within the pocket **642**, such that the sole plate **636** can be secured in the pocket **642** by the cushion layer **352**. In particular, the sole plate **636** can be secured between the midsole member **632** and the cushion layer **652**, with the midsole member **632** in contact with a first side of the sole plate **636** and the cushion layer **652** in contact with a second side of the sole plate **636** that is opposite the first side. The cushion layer **652** may extend to cover the entirety of the second side of the sole plate **636**. It is appreciated that the cushioning layer **652** can be coupled the midsole member **632**. Moreover, the position of the sole plate **636** in relation to the first midsole member **632** and the cushion layer **652** can effectively adjust the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In some embodiments, the ground-engaging surface is not continuous along the medial side **616** of the midfoot region **610** of the article of footwear. Correspondingly, the outsole **630** may comprise multiple outsole portions that are spaced apart from one another, such that the ground engaging surface is not continuous between the outsole portions. For example, as illustrated in FIG. **8**B, the outsole **630** includes a first outsole portion **630***a* positioned in the forefoot region **608** and generally forward of the widest portion **607** (e.g., to extend into the exit region **623**). Additionally, the outsole **630** includes a second outsole portion **630***b* extending from the widest portion **607** and along the lateral side **618** of the midfoot region **410** to the heel region **612**. Further, the outsole **630** can include a third outsole portion **630***c* that is coupled to the medial side **616** of the first midsole member in the heel region **612** (e.g., to extend into the entry region **621**).

In some aspects, however, the articles of footwear **500**, **600** differ from each other. For example, as shown in FIGS. **9**D, **9**E and FIG. **9**F, which is a cross-sectional view taken along line **9**F-**9**F in FIG. **9**B within the forefoot region **608**, the cushion layer **652** extends even farther into the forefoot region **608**. Further, as shown in FIGS. **9**D-**9**M, the cushion layer **652** can be configured to cover the entirety of the second side of the sole plate **636** when the sole plate **636** and the cushion layer **652** are received within the pocket **642**. Additionally, the midsole member **632** has a more consistent thickness from the midfoot region **610** through the forefoot region **608** and is thinner than the midsole member **532** near the midfoot region **610** and thicker in the portion beneath a user's toes in the forefoot region **608**. The midsole member **632** also has a chamber **654** extending upward into the midsole member **632** and extending from the forefoot region **608** into the cutout portion **638**. In some embodiments, the chamber **654** can be arch-shaped. Looking at FIGS. **9**F-**9**H, in those embodiments, the height of the chamber **654** (defined as measured from the ground surface **624** to the top of the chamber **654** taken along the shortest path) can be about half the thickness of the midsole member **632** (defined as measured from the top of the chamber **654** to the top of the midsole member **632** taken along the shortest path). In some embodiments, the width of the chamber **654** can decrease moving from the forefoot region **608** to the cutout portion **638**. In some embodiments the area of the cross-section of the chamber **654** can remain constant moving from the forefoot region **608** to the cutout portion **638** (e.g., as the width of the chamber **654** decreases, the height of the chamber **654** increases).

FIGS. **10**A through **10**M illustrate another embodiment of an article of footwear **700** according to the invention. In many aspects, the article of footwear **700** is similar to the article of footwear **300** described above and similar numbering in the **700** series is used for the article of footwear **700**. For example, the article of footwear **700** has an upper **702**, a sole structure **704**, an interior cavity **706** defined by the combination of the upper **702** and the sole structure **704**, a forefoot region **708**, a midfoot region **710**, a heel region **712**, a medial side **716**, and a lateral side **718**. Further, the sole structure **704** has an outsole **730**, a midsole member **732** (e.g., a first midsole member or cushion layer) with a pocket **742**, a sole plate **736**, a cushion layer **752** (e.g., a second midsole member or cushion layer), an arched section **740**, and a cutout portion **738**. The midsole member **732**, the cushion layer **752**, and the sole plate **736** can form a cushioning system of the sole structure **704** (e.g., a midsole of the sole structure **704**). Additionally, the sole structure **704** is shaped to define an entry angle **720** in the heel region **712** and an exit angle **722** in the forefoot region **708** with respect to a flat ground surface **724**. Similarly, in some embodiments, the entry angle **720** can be about 30 degrees and the sole structure **704** can start angling away from the ground surface **724** approximate the area underneath the heel of a user's foot (shown in FIG. **4**). Further, in some embodiments, the exit angle **722** can be about 15 degrees and can start angling away from the ground surface **724** approximate the area underneath the balls of a user's foot (shown in FIG. **4**).

Additionally, the midsole member **732**, the sole plate **736**, and the cushion layer **752** can be similarly constructed as the midsole member **332**, the sole plate **336**, and the cushion layer **352**. For example, the midsole member **732** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material; the sole plate **736** can be formed from a PU plastic, such as a thermoplastic polyurethane (TPU) material, thermoplastic elastomers and fiber reinforced thermoplastics consisting of block copolymers, carbon fiber, or other rigid, semi-rigid, or spring-like materials and combinations thereof; and the cushion layer **752** can be formed from a thermoplastic elastomer material, for example, a polyether block amide (PEBA), including PEBAX® foam.

Another similarity is that the sole plate **736** has a shape that is similar to but proportionally smaller than the midsole member **732** throughout the forefoot, midfoot, and heel regions **708**, **710**, **712** (shown in FIG. **10**E). Additionally, the pocket **742** and the sole plate **736** are correspondingly shaped such that a peripheral envelope of the pocket **742** bounds and can be in contact with an outer periphery of the sole plate **736**. Put another way, the pocket **742** can be shaped to receive the sole plate **736**, and the sole plate **736** can be shaped to be received in the pocket **742**. Further, the cushion layer **752** can also be positioned within the pocket **742**, such that the sole plate **736** can be secured in the pocket **742** by the cushion layer **352**. In particular, the sole plate **736** can be secured between the midsole member **732** and the cushion layer **752**, with the midsole member **732** in contact with a first side of the sole plate **736** and the cushion layer **752** in contact with a second side of the sole plate **736** that is opposite the first side. It is appreciated that the cushioning layer **752** can be coupled the midsole member **732**. Moreover, the position of the sole plate **736** in relation to the first midsole member **732** and the cushion layer **752** can effec-

tively adjust the running posture of the user to be a forward tilt and moves the running motion of the user toward their forefoot.

In some aspects, however, the articles of footwear **300**, **700** differ from each other. For example, the cushion layer is different. As shown in FIGS. **10**D and **10**F, which is a cross-sectional view taken along line **10**G-**10**G in FIG. **10**B within the forefoot region **708**, the cushion layer **752** extends into the forefoot region **708**.

The above-described sole plates, such as sole plates **136**, **236**, **336**, **436**, **536**, **636**, and **736** provide a rigid sole that can promote a faster takeoff when running. In particular, the fulcrum of the rocking member creates a propulsion lever between a midfoot region and a heel region of the wearer that allows the wearer to accelerate faster and create a toe-off movement where the forefoot region of the wearer propels the wearer forward. Further, embodiments of the sole structures described herein can provide a training aid or tool that can be used to strengthen entire leg and foot muscles of a wearer and adjust their running posture to a forward-tilt position that promotes constant muscle tension.

Any of the embodiments described herein may be modified to include any of the structures or methodologies disclosed in connection with different embodiments. Further, the present disclosure is not limited to articles of footwear of the type specifically shown. Still further, aspects of the articles of footwear of any of the embodiments disclosed herein may be modified to work with any type of footwear, apparel, or other athletic equipment.

As noted previously, it will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

INDUSTRIAL APPLICABILITY

Numerous modifications to the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the invention and to teach the best mode of carrying out same. The exclusive rights to all modifications which come within the scope of the appended claims are reserved.

We claim:

1. A sole structure for an article of footwear having an upper, the sole structure comprising:

an outsole;

a midsole member disposed between the outsole and the upper, the midsole member having a pocket extending from a heel region to a forefoot region; and

a sole plate disposed within the pocket, the sole plate extending from the heel region into the forefoot region,

wherein the sole structure defines a substantially flat region upon which the sole structure is configured to rest when in contact with a ground surface, the substantially flat region defining a resting plane,

wherein, in the heel region, the sole structure is shaped to define an entry region that is configured to form a gap between the midsole member and the resting plane, the entry region curving upward to form an angled portion that is substantially flat between a first end and a second end so that the angled portion is configured to be angled at an entry angle relative to the ground surface when viewed from a lateral side or a medial side of the sole structure,

wherein the first end of the angled portion is below a heel end of the sole plate and the second end of the angled portion is above the heel end of the sole plate to define a heel end of a ground engaging surface that is above the heel end of the sole plate, and

wherein the heel end of the sole plate is positioned over the gap where the gap has a first thickness that is greater than a second thickness of the outsole at the heel end of the sole plate, each of the first thickness and the second thickness taken along a direction that is normal to the resting plane.

2. The sole structure of claim **1**, wherein the midsole member is a first midsole member and the sole structure further includes a second midsole member disposed between the midsole member and the upper.

3. The sole structure of claim **2**, wherein the second midsole member is positioned on top of the sole plate so that the sole plate is positioned between the first midsole member and the second midsole member.

4. The sole structure of claim **1**, wherein the sole plate is a carbon fiber plate that is similarly shaped to and proportionally smaller than the midsole member in at least one of the forefoot region, a midfoot region, or the heel region of the sole structure.

5. The sole structure of claim **1**, wherein the midsole member defines a longitudinal channel extending from a heel end of the sole structure and into a midfoot region.

6. The sole structure of claim **5**, wherein the outsole includes a first outsole member and a second outsole member that are separated from one another by the longitudinal channel so that the ground engaging surface is not continuous across the heel region between the lateral side and the medial side of the sole structure.

7. The sole structure of claim **1**, wherein the outsole includes a first outsole member in the forefoot region and a second outsole member in the heel region, and

wherein the ground engaging surface is not continuous along a medial side of a midfoot region of the sole structure.

8. The sole structure of claim **1**, wherein the exit region includes a rocking region that extends from the substantially flat region, the rocking region creating a fulcrum for the sole plate to help propel a user forward during toe off.

9. The sole structure of claim **8**, wherein the fulcrum is positioned to be proximate metatarsal bones of the user.

10. The sole structure of claim **1**, wherein the first end of the angled portion is closer to the forefoot region than is the heel end of the sole plate and the second end of the angled portion is farther from the forefoot region than is the heel end of the sole plate.

11. The sole structure of claim **1**, wherein the outsole extends onto the angled portion.

12. The sole structure of claim **1**, wherein the entry region includes a first rocking region that extends from the substantially flat region to the angled portion, the first rocking region being entirely convex between the substantially flat region and the angled portion.

13. The sole structure of claim 12, wherein, in the forefoot region, the sole structure is shaped to define an exit region that is configured to curve to angle away from the resting plane, and

wherein the exit region includes a second rocking region that forms a fulcrum proximate a widest portion of the sole structure, the second rocking region forming a propulsion lever with the sole plate that is configured to propel a user forward during toe off.

14. The sole structure of claim 13, wherein the angled portion of the entry region is a first angled portion and the exit region includes a second angled portion extending from a third end positioned at the second rocking region to a fourth end that corresponds with a toe end of the ground engaging surface, the second angled portion being substantially flat between the third end and the fourth end so that the second angled portion is configured to be angled at an exit angle relative to the resting plane.

15. The sole structure of claim 14, wherein the entry angle is thirty degrees and the exit angle is fifteen degrees.

16. The sole structure of claim 1, wherein the angled portion that is substantially flat includes an inflection point.

17. The sole structure of claim 13, wherein the substantially flat region extends continuously between the entry region and the exit region.

18. The sole structure of claim 1, wherein the midsole member includes an arched section in a midfoot region.

19. The sole structure of claim 1, wherein the sole structure has a cutout portion.

20. The sole structure of claim 19, wherein the sole plate is visible from an exterior of the article of footwear through the cutout portion.

21. The sole structure of claim 20, wherein the midsole member includes an arched section in a midfoot region, and

wherein the cutout portion is positioned adjacent to the arched section.

22. The sole structure of claim 20, wherein the cutout portion defines a cutout length along a longest portion of the cutout portion, the cutout length extending in a heel-toe direction and parallel with respect to the ground surface when the sole structure is resting on the ground surface,

wherein the cutout portion defines a cutout width at a widest portion of the cutout portion, the cutout width extending in a medial-lateral direction and parallel with respect to the ground surface when the sole structure is resting on the ground surface, and

wherein the cutout length is greater than the cutout width.

23. The sole structure of claim 20, wherein the outsole extends partially around the cutout portion.

24. The sole structure of claim 20, wherein the sole plate comprises an insignia that is visible through the cutout portion.

25. The sole structure of claim 1, wherein the midsole member comprises an external groove defined in the heel region.

26. The sole structure of claim 25, wherein a portion of the external groove is positioned entirely above the sole plate.

27. The sole structure of claim 25, wherein a heel end of the external groove is positioned above the second end of the angled portion.

28. The sole structure of claim 27, wherein the external groove is positioned above a portion of the upper.

29. The sole structure of claim 1, wherein a portion of the medial side and a portion of the lateral side of the sole structure each comprise a plurality of undulating surfaces.

30. A sole structure for an article of footwear having an upper, the sole structure comprising:

an outsole;

a midsole extending between the outsole and the upper, the midsole including:

a first midsole member coupled to the outsole and extending from a forefoot region to a heel region of the sole structure, wherein the sole structure defines a substantially flat region upon which the sole structure is configured to rest when in contact with a ground surface, the flat region defining a resting plane, and wherein the first midsole member defines an entry region that is configured to form a gap between the first midsole member and the resting plane at a heel end in which the first midsole member defines a substantially flat angled portion that is configured to be angled away from the ground surface by a first angle when viewed from a lateral side or a medial side of the sole structure, and

a second midsole member coupled to the upper and positioned between the first midsole member and the upper, the second midsole member extending from the heel region to the forefoot region; and

a sole plate positioned within the midsole between the first midsole member and the second midsole member,

wherein the substantially flat angled portion of the entry region extends from a first end to a second end, the first end being positioned below a heel end of the sole plate and the second end being positioned above the heel end of the sole plate, and

wherein the heel end of the sole plate is positioned over the gap where the gap has a first thickness that is greater than a second thickness of the outsole at the heel end of the sole plate, each of the first thickness and the second thickness taken along a direction that is normal to the resting plane.

31. The sole structure of claim 30, wherein the sole plate is comprised of carbon fibers and extends from the heel region to the forefoot region.

32. The sole structure of claim 30, wherein the outsole extends at least partially into the entry region.

33. The sole structure of claim 30, wherein the first midsole member further defines an exit region in the forefoot region in which the first midsole member is configured to curve away from the ground surface from approximately a widest portion of the sole structure to extend to a toe end of the sole structure.

34. The sole structure of claim 30, wherein the first midsole member defines a pocket and at least one of the sole plate or the second midsole member is disposed at least partially within the pocket.

35. The sole structure of claim 30, wherein the substantially flat angled portion includes an inflection point.

36. The sole structure of claim 33, wherein the substantially flat region extends continuously between the entry region and the exit region.

37. The sole structure of claim 30, wherein the first midsole member includes an arched section in a midfoot region.

38. The sole structure of claim 30, wherein the sole structure has a cutout portion.

39. The sole structure of claim 38, wherein the sole plate is visible from an exterior of the article of footwear through the cutout portion.

40. The sole structure of claim 39, wherein the midsole includes an arched section in a midfoot region, and

wherein the cutout portion is positioned adjacent to the arched section.

41. The sole structure of claim **39**, wherein the cutout portion defines a cutout length at a longest portion of the cutout portion, the cutout length extending in a heel-toe direction and parallel with respect to the ground surface when the sole structure is resting on the ground surface,

wherein the cutout portion defines a cutout width at a widest portion of the cutout portion, the cutout width extending in a medial-lateral direction and parallel with respect to the ground surface when the sole structure is resting on the ground surface, and

wherein the cutout length is greater than the cutout width.

42. The sole structure of claim **39**, wherein the outsole extends partially around the cutout portion.

43. The sole structure of claim **39**, wherein the sole plate comprises an insignia that is visible through the cutout portion.

44. The sole structure of claim **30**, wherein the midsole comprises an external groove defined in the heel region.

45. The sole structure of claim **44**, wherein a portion of the external groove is positioned entirely above the sole plate.

46. The sole structure of claim **44**, wherein a heel end of the external groove is positioned above the second end of the angled portion.

47. The sole structure of claim **46**, wherein the external groove is positioned above a portion of the upper.

48. The sole structure of claim **30**, wherein a portion of the medial side and a portion of the lateral side of the sole structure each comprise a plurality of undulating surfaces.

49. A sole structure for an article of footwear having an upper, the sole structure comprising:

an outsole;

a first midsole member extending from a forefoot region to a heel region of the sole structure, the first midsole member defining an entry region in the heel region, an exit region in the forefoot region, and a substantially flat region extending between the entry region and the exit region, wherein the sole structure is configured to rest on the substantially flat region when the sole structure is in contact with a ground surface, the substantially flat region defining a resting plane;

a second midsole member positioned between the first midsole member and the upper, the second midsole member extending from the heel region to the forefoot region; and

a sole plate positioned between the first midsole member and the second midsole member, the sole plate including a heel end that is disposed in the heel region,

wherein the entry region is configured to form a gap between the first midsole member and the resting plane and includes an angled portion and a first rocking region, the first rocking region extending between the substantially flat region and the angled portion, the angled portion extending from a first end that is positioned at the first rocking region and below the heel end of the sole plate to a second end that is positioned above the heel end of the sole plate, and the angled portion being substantially flat between the first end and the second end to define an entry angle relative to the substantially flat region when viewed from a lateral side or a medial side of the sole structure,

wherein the exit region is shaped to create a fulcrum for the sole plate to help propel a user forward during toe off, and

wherein the heel end of the sole plate is positioned over the gap where the gap has a first thickness that is greater than a second thickness of the outsole at the heel end of the sole plate, each of the first thickness and the second thickness taken along a direction that is normal to the resting plane.

50. The sole structure of claim **49**, wherein the sole plate defines a first region with a first stiffness and a second region with a second stiffness that is greater than the first stiffness.

51. The sole structure of claim **49**, wherein the outsole is coupled to the first midsole member, the outsole including a first outsole portion positioned in the forefoot region and a second outsole portion positioned in the heel region, the first outsole portion and the second outsole portion being spaced from one another.

52. The sole structure of claim **49**, wherein the exit region includes a second rocking region that curves upwardly from approximately a widest portion of the sole structure to extend to a toe end of the sole structure.

53. The sole structure of claim **49**, wherein the substantially flat region includes an inflection point.

54. The sole structure of claim **49**, wherein the substantially flat region extends continuously between the entry region and the exit region.

55. The sole structure of claim **49**, wherein the first midsole member includes an arched section in a midfoot region.

56. The sole structure of claim **49**, wherein the sole structure has a cutout portion.

57. The sole structure of claim **56**, wherein the sole plate is visible from an exterior of the article of footwear through the cutout portion.

58. The sole structure of claim **57**, wherein the first midsole member includes an arched section in a midfoot region, and

wherein the cutout portion is positioned adjacent to the arched section.

59. The sole structure of claim **57**, wherein the cutout portion defines a cutout length at a longest portion of the cutout portion, the cutout length extending in a heel-toe direction and parallel with respect to the ground surface when the sole structure is resting on the ground surface,

wherein the cutout portion defines a cutout width at a widest portion of the cutout portion, the cutout width extending in a medial-lateral direction and parallel with respect to the ground surface when the sole structure is resting on the ground surface, and

wherein the cutout length is greater than the cutout width.

60. The sole structure of claim **57**, wherein the outsole extends partially around the cutout portion.

61. The sole structure of claim **57**, wherein the sole plate comprises an insignia that is visible through the cutout portion.

62. The sole structure of claim **49**, wherein the first midsole member comprises an external groove defined in the heel region.

63. The sole structure of claim **62**, wherein a portion of the external groove is positioned entirely above the sole plate.

64. The sole structure of claim **62**, wherein a heel end of the external groove is positioned above the second end of the angled portion.

65. The sole structure of claim **64**, wherein the external groove is positioned above a portion of the upper.

66. The sole structure of claim **49**, wherein a portion of the medial side and a portion of the lateral side of the sole structure each comprise a plurality of undulating surfaces.

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